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BALANCERS AND MOTOR-GENERATOR SETS.

An interesting paper discussing the advantage of the balancer for three-wire lighting sets was presented at the recent convention of the National Electric Light Association, and is reprinted on another page of this issue. The author, Mr. Budd Frankenfield, after presenting the various points to be considered in deciding between a balancer and a three-wire dynamo, takes the view that for a good many reasons the balancer is the more desirable machine. There are a number of different types of balancer, but essentially they consist of two dynamos connected in series across the outer mains. The third wire is connected to the intermediate point. Assuming the machines to have a shunt characteristic, an increase in load on one side of the three-wire system would lower the voltage across that machine, a corresponding rise in voltage taking place across the other. This tends to cause the latter machine to operate as a motor and drive the other as a generator, so that a portion of the greater electrical load is thus transferred mechanically through the balancer to the least loaded side. There are a number of arrangements whereby the regulation of the system may be improved, one of the most satisfactory being to cross-excite the fields, whereby a tendency for the machine across the lightly loaded circuit to operate as a motor is increased.

The general arrangement when a balancer is employed is simple, and no new complications are introduced into the station, although the balancer makes it possible to supply the three-wire system from a number of large two-wire dynamos connected in parallel. An alternative plan has been developed to do away with the balancer by making a third connection upon the generator. Unfortunately, these three-wire machines are not free from objections, as the load on one side affects the regulation of both sides, and it is not possible to control independently the two legs of the dynamo. This type of generator developed to eliminate the balancer has brought in other troubles. It is a case where too great refinement seems to have been sought. The conclusions reached by Mr. Frankenfield are that the balancer system gives better regulation, can take care of overloads more easily, calls for standard machines only, and there are no complications introduced. These reasons are thought to be sufficient to decide in favor of this arrangement, which is one that has already been adopted to a certain extent in Europe.

There is another instance in which the motor-generator promises to become useful, which is in supplying single-phase railways with power from three-phase distributing systems. Here again the simple arrangement of utilizing a motor to drive a generator gives flexibility of regulation, does not unbalance the

supply system, and introduces no new complications in the machines themselves. To seek to avoid this double transformation from electrical power to mechanical power, and back again to electrical power, may, in some cases, be an unnecessary refinement, for although this arrangement would apparently introduce unnecessary losses, it avoids other troubles which are not less important. Not infrequently it is necessary to go to considerable expense in order to provide good regulation, and it may not infrequently be found that a motor-generator set used either as a balancer or as a transformer may give the desired control of the system at but a slight expense in wasted power.

BUGS.

Although every one engaged in electrical matters fully understands the technical, or perhaps slangy, expression of the term "bug" to indicate any derangement in electrical devices, yet they may not realize to what an extent bugs actually produce serious disturbances in telephony.

One of the earliest instances appears to have been that of mysterious openings of telephone lines at Savannah, Georgia, which was found to be in the small tubular fuses at the ends of the cables, where the strips of thin alloy, which forms the fuses, was found to be corroded at the same point, which opened the line. It was ascertained that a small insect laid its eggs in these tubes, and that the formic acid secreted by the larvæ corroded the metal.

Telephone poles are seriously impaired by animal life, not merely the small microscopic germs, known as merulius lachrimans, which cause dry rot near to the ground level, and small as they may be, they are sufficiently potent in their myriads to perform acts which mankind is unable to avert by any local treatment of poles.

Boring worms, such as the toredo, perforate poles in tropical waters unless the poles be highly saturated with creosote.

The aerial telephone cables in China and Japan are attacked by varieties of insects which lay their eggs in bamboo stalks, and being provided with mandibles sharp enough to cut through the silicious covering of such stalks, the lead alloy of telephone cable sheaths presents no impediment to their progress. These attacks are limited to the vicinity of bamboo thickets and in such places the Japanese protect their cables with burlap yarn soaked in linseed oil.

The telephone cables in Australia are attacked by several varieties of insects, particularly the Jesuit beetle.

The telephone cables in those portions of the stock yards in Chicago near the poles where the bones are cleaned and ground are attacked by insects which feed upon the bones.

In Texas, a small insect who bears, rather than answers to, the sonorous name of dermestes laderius, perforates the telephone cables.

The transmission on telephone circuits along the coast of Southern California was very much impaired at times, and it was found that this was due to the webs of a great number of small spiders which had infested the region. When the air was dry, the webs being insulators, did not interfere with the transmission, but on the occurrence of rain, or the heavy dews which abound in that locality, the combined conductivity of wet spider webs was sufficient to cause serious results.

The faintness of transmission on a telephone line connecting Arizona Dam and Tonta Basin indicated that some trouble was occurring on the line, and a man had gone but a short way when he saw a rattle-snake connecting the two wires upon which he had been tossed by an ugly steer which was waiting for the snake to come to earth and resume hostilities.

The lineman became most literally a "trouble shooter" before the cross was removed.

Passing by the primitive forms of life represented by the insects, the higher forms also show pernicious activity in their attacks upon telephone lines, such as the woodpeckers, which frequently bore into poles and riddle them. Woodpeckers also perforate the sheaths of cables, and in one instance a squirrel gnawed several cables on one pole in eastern Massachusetts and, to use the words of a camera advertiser, "The rain did the rest."

Bears in the northern woods, from ocean to ocean, attack the poles of the telephone lines by means of which the lumber industry is now operated. The humming of the wires probably constitute an inviting sound, asking the bears to a feast of honey which is as imaginative as the feast of Barmecides.

Rats are so eager to gnaw lead covered cables that cats are as necessary an equipment in electrical supply storehouses as they are in those for produce at the markets.

THE ELECTRIC ARC AS A SOURCE OF HIGH-FREQUENCY OSCILLATIONS.

The suggestion, made some months ago by Poulsen, that the singing arc might be employed effectively for producing the high frequency oscillations used in wireless telegraphy, and might even provide a solution of the wireless telephone problem, was accepted warmly and soon tried by numerous investigators. It may, perhaps, be too soon to pass judgment upon the device, yet the fact that but little has been said about the success of the method seems to indicate that either the hope for improvement has not been realized, or the method has not yet been brought under complete control.

Poulsen's method, it will be remembered, was to set up a singing arc in a neutral atmosphere, as in this way a much higher frequency was obtainable, but the question then arose whether the oscillations thus obtained were at a definite frequency or were simply discharges succeeding each other at very short intervals. What is needed for wireless telegraphy is a high-frequency harmonic vibration, in order that the full benefits of resonance and tuning might be secured, and it was possible that the apparent gain due to the use of the singing arc lay rather in the greater amount of energy which could thus be radiated than in the constancy of the pitch. In other words, the apparently continuous character of the effect merely made it possible to utilize a greater number of discharges when sending out a single signal, but did not give the advantages which would

result from a true harmonic vibration. This question is one of great importance for the art of wireless communication. Strange as it may seem, however, it is apparently of less consequence, at the present time, at least, so far as wireless telephony is concerned, because the frequency is so high that it does not matter whether it be harmonic or simply successive discharges, the difference does not affect the voice. When, however, the telephonic branch of the wireless art has reached the stage now occupied by the older branch, and distance and tuning become important, the need for a true harmonic oscillation will be as great.

Some light is thrown on this important question in a contribution to the *Bulletin* of the Bureau of Standards, at Washington, by Mr. L. W. Austin, which appears in the May number. Mr. Austin has studied this phenomenon under a variety of conditions, such as varying the surrounding medium, varying the pressure of the latter and using electrodes of different materials. Some of his conclusions are interesting and instructive. He found that an arc between graphite electrodes in media at normal pressure, sets up oscillations which are not only not sinusoidal, but not even symmetrical. The frequency increases with diminishing arc length, but does not seem to depend upon the intensity of the oscillations. Surrounding the arc by hydrogen or steam apparently merely increases the intensity of the oscillations.

Better results were obtained when the arc was surrounded by compressed air. Under these conditions a higher potential may be employed and the arc takes on all the characteristics of a very rapid discharge. The frequency is independent of the length of the arc and of the current and depends only upon the characteristics of the oscillatory circuit. Moreover, it seems to be sinusoidal and about sixty per cent of the available power may be derived from the oscillations. There is also none of the hissing noise which accompanies the low-voltage arc, a characteristic of advantage for telephonic experiments.

Mr. Austin has cleared up certain points concerning the oscillating arc, and indicates the direction in which the best results seem most likely to be secured. However, there is more work of an experimental character to be done which might profitably engage the attention of some of the new students in the field of wireless communication.

AN ELECTRICALLY DRIVEN HYDRAULIC ELEVATOR.

Unusual applications of electric motors are always interesting, not only because they are additional evidence of the growing popularity of this machine as a power producer, but because they frequently illustrate some peculiar advantage of the machine. A short time ago reference was made to the growing tendency to displace steam-using apparatus, even when the rest of the equipment was not changed. As an illustration of this was mentioned the occasional application of the electric motor to driving the pumps for an hydraulic elevator. Certain engineers prefer the latter to the drum elevator driven by a motor, but find it more convenient to supply the hydraulic pressure by means of a motor, thus introducing an additional link in the system.

A somewhat similar use of the motor is being tried in England, but the application is a little different. The idea was to retain what are supposed to be the advantages of the hydraulic elevator, but to do away with the pumps. This was accomplished by putting an extra hydraulic ram in place of the pump, and driving the piston in this ram by means of a screw, to which was attached the motor. Just what is gained with this arrangement is not quite clear, for it would seem to be unnecessary to introduce the two links represented by the two rams, instead of a sheave of pulleys or a drum over which the cable passes. However, there may be some features of the system which have not been brought out. The application is, nevertheless, an interesting one. Everywhere to-day when one wants power he prefers to buy it at a reasonable price, rather than produce it himself, and the most satisfactory and convenient appliance is undoubtedly the electric motor. This certainly accounts for its frequent use as a driving appliance in systems which, themselves, seem indirect and expensive.

THE CONVENTION OF THE ILLUMINATING ENGINEERS.

The first convention of the Illuminating Engineering Society will be held at Boston, Mass., during "Old Home Week," on July 30 and 31. Seldom has an organization of technical men grown as has this one, and it is expected that this gathering will make a fine show of strength. Under the energetic leadership of the several committees a first-class technical programme is assured. There will be also an interesting display of illumination apparatus and measuring instruments. The features of street illumination will be especially marked, and a fine programme of entertainment is promised.

HIGH-TENSION SWITCHBOARD CONSTRUCTION.

One of the papers read at the recent convention of the American Institute of Electrical Engineers dealt with modern methods of constructing high-tension switchboards. This was by Mr. S. Q. Hayes, and shows what a considerable part of the modern generating and receiving station the switchboard appliances now constitute. This part of the station has gone on increasing in size and complexity until to-day it is often necessary to provide a separate structure to house it. This suggests the query whether some way can not be found for avoiding part at least of the expense and complexity thus introduced. The concluding paragraphs of Mr. Hayes's paper suggest that this is not impossible, and that by placing a good deal of this apparatus out of doors a safer, simpler and less expensive arrangement will be had. This should be possible even in climates where the winters are rather severe, if the outdoor type of construction were adopted and a shed erected merely to keep off snow and rain. It will be interesting to note that a part of the high-tension apparatus on the Niagara, Lockport & Ontario Power Company's transmission lines is erected on poles just without the substations. It is to be hoped that this type of construction will prove reliable, and that thereby the switching arrangements of high-tension systems may be simplified.

Boiler, Engine and Generator Testing and Management—I.

By Charles L. Hubbard.

The Management of Steam Boilers.

ALTHOUGH each boiler plant has its own peculiarities and requires special management to a certain extent, depending upon local conditions, there are, however, certain general rules applying to the care of all boilers, which the engineer or fireman can easily adapt to his own plant.

Most of the points covered in the following article are probably well known to the older and more experienced men, but there are always beginners who are looking for practical information, and it is hoped that men of this class especially may find something of value in what follows.

One of the first points to be noted before getting up steam is to determine carefully the water-level in each unit of a battery of boilers; this is most quickly done by an inspection of the water-glass, but this should be checked by trying the gauge cocks, as the glasses are liable to be misleading at times, owing to the presence of dirt, foam, etc.

The safety valves should be lifted daily to see that they are in working order, and cords or chains for this purpose should be brought to some accessible point. When starting up a fire which has been banked over night the grates should be shaken slightly to clear them of ashes and clinkers, and the drafts opened to brighten the fire before adding fresh fuel.

In starting a new fire of anthracite coal under a boiler which has been temporarily out of use, a stick of wood should be placed across the front of the grate and a thin layer of coal spread over the grate.

Pieces of wood should now be closely laid at right angles to the cross-stick already mentioned, and the whole covered over with coal, and the wood ignited by means of oily waste, or shavings.

The furnace doors should be kept open until the fire is well started, after which the coal should be spread evenly over the entire grate surface and fresh fuel added. The furnace doors should now be closed and the draft admitted through the ash-pit in the usual manner.

When starting a fire with bituminous coal, the wood should be laid directly upon the grate bars with the coal above it.

In getting up steam, especially when new fires are started, the boiler and setting should be allowed to warm up gradually, so as to prevent excessive strains due to unequal expansion of the shell and tubes. This applies more especially to fire-tube boilers, as they contain a greater volume of water and the joints are more directly exposed to the fire. Water-tube boilers may be pushed more rapidly, although due care should be exercised, whatever the type.

There are two general methods of adding fresh fuel, depending upon the kind of coal used and the type of boiler. One method often employed where two furnaces lead to a common combustion chamber is to fire one side at a time, as in this way the fire on one-half of the grate will be bright at all times and the hydrocarbons given from the freshly fired coal will be burned by the hot gases present in the furnace and combustion chamber. In this way the fire is not checked to such an extent as when coal is added to the whole grate. This is called alternate firing. In spreading, so called, the coal is distributed in small quantities at frequent intervals over the entire surface of the fire.

The entrance of cold air should be guarded against by keeping the furnace doors closed except when actually introducing the fuel. With anthracite coal very good results may be obtained in this manner and a comparatively even fire maintained at all times. After firing fresh coal, the draft-plates should be opened for a short time until the gas has burned off. Bituminous coal requires a different method of firing, owing to the greater amount of smoke given off when fresh fuel is added.

The coal is first placed on the front of the grate just back of the firing door, where it is allowed to remain until the greater part of the hydrocarbons are given off, which requires from twenty to thirty minutes under ordinary conditions. During this process, air should be admitted through the draft-plates to assist in the combustion of these gases.

After the coking process, so called, the coal is pushed back and spread over the grate and fresh fuel added as before, and the operation repeated. The best depth of fire to carry will depend upon the kind of coal used and the power of the chimney draft. Under ordinary conditions with coarse coal the depth may be about twelve inches, which should be reduced to four or five inches with fine coal or weak draft. Forced draft calls for a heavier fire than a natural draft, and bituminous coal allows of a thicker fire for a given draft than anthracite. In each particular case the fireman should learn by experiment the proper depth of fire to carry for obtaining the best results, and then adhere to it.

The fires should not be cleaned oftener than is necessary to keep them free from ashes and clinkers; this, however, will depend upon the grade of fuel used, and must be determined by observation. Before cleaning the fires they should be allowed to burn down somewhat, but not so much that they will not come up quickly afterward. Some firemen prefer to first clean the front of the grate and then the rear, while others clean a side at a time. This is a matter of choice and either way should give satisfactory results when properly carried out. Care should always be taken to see that the boiler is supplied with water and that sufficient steam is provided by the other boilers in the battery to last during the process of cleaning.

In banking a fire over night, it should first be cleaned, and the live coals pushed back near the bridge wall and covered to a good depth with fresh coal. The fire doors should be left open and the dampers closed, or nearly so, just enough draft being provided to carry away any gases which may be given off. All trimmings, such as pressure gauges, water-glass and cocks, and safety valves, should be kept in working order at all times and should be frequently tested. If the pointer of the pressure gauge does not stand at the zero mark when under no pressure, it should be compared with a standard gauge and the proper adjustments made. Should the pressure rise at any time above the range of the gauge and the safety-valve fail to open, the fires should at once be banked and both the safety-valve and gauge should be tested. After the pressure has dropped, the gauge should be compared with a standard to make sure that it has not been overstrained and thrown out of adjustment. Fusible plugs, in order to be re-

liable, must be frequently cleaned and scraped to prevent an accumulation of scale or other non-conducting coating. All parts of the boiler exposed to the passage of the gases should be kept clean and free from soot and ashes. A good rule to follow in this connection is never to allow a coating over one-sixteenth of an inch to collect in any of the tubes or flues. It is a good plan when the man-hole or hand-hole covers are removed for inspection to carefully clean and oil the seats or bearing surfaces. If the boiler is provided with a surface blow-off it should be used only when the demand for steam is light.

The frequency of blowing-off the boilers will depend upon local conditions. If the water is muddy or contains oil from a condenser or heating system, it should be blown out daily and should be completely emptied at least once in two weeks, under ordinary conditions, and oftener if found desirable. Never blow off a boiler under a high pressure.

Boilers should always be provided with two separate methods for feeding, each of sufficient capacity to supply the entire plant in case of accident or repairs. Water should be fed into the boilers continuously rather than in large quantities at intervals. All valves and checks in the feed-piping should be regularly inspected, and kept clean and in good repair. If it becomes necessary to shut down the engine with a heavy fire under the boilers, and steam at the blowing point, the drafts should be closely watched until the safety-valve lifts to see that the latter works freely. If the safety-valve is of sufficient size and in working order, the pressure can not rise dangerously high with the pump or injector forcing cool water into the boiler. Should it be discovered that the water is low in one of the boilers, wet ashes or fresh fuel should be used to cover the fire and the furnace doors be left open to admit cool air.

The fire should not be drawn until such time as it can be done without increasing the heat under the boiler. All conditions should be kept as nearly constant at such times as possible, so far as the draft of steam upon the boilers is concerned, and under no conditions should cold water be fed into the boiler.

The engine should be allowed to run until it stops if there is only a single boiler in use, after which the throttle may be closed. The main point to be kept in mind is to check the fire and cool the boiler down. In case of a fracture in the main steam pipe the water-level is usually lowered very rapidly and the first thing is to deaden the fire. If the rush of steam is not too great, and the gauge-glass can be kept in view, the water-level may often be maintained by starting or increasing the speed of the pump.

Sudden leaks in the blow-off pipe or the melting of a fusible plug call for the same procedure as above.

In case a boiler foams, closing the stop-valve will often cause the water to become quiet and show at its true level in the gauge-glass. When caused by dirty water, the boiler should be blown out and fresh water added. Should priming occur, the water-level may be lowered. Never empty a boiler when hot as it is likely to cause the grease and sediment to bake into a hard substance which is difficult to remove from the plates. The outside conditions surrounding a boiler should be carefully observed and proper means taken to prevent the dripping of water from leaky valves or other sources from coming in contact with the shell. This applies especially in cases where the boiler is enclosed in brickwork or other insulating material.

Opinions vary as to the best way of preserving a boiler which is to remain out of use for some time.

Some engineers recommend draining and thoroughly drying it and then placing trays of quicklime in the interior. Another way is to completely fill it with water and add a solution of soda.

An article upon the care of a boiler plant is not complete without some reference to corrosion and incrustation. A careful study of this subject, however, based upon the experience of a large number of designing and operating engineers, seems to indicate that the only satisfactory method of dealing with these important matters is to subject a sample of the feed-water to a competent chemist for a careful analysis, and to obtain from him a suitable remedy for neutralizing the injurious effects of the impurities found.

The leading boiler insurance companies usually do this for their clients free of charge.

The great variety of impurities, and the varying quantities of each found in different localities, makes it impossible to give definite solvent or precipitating solutions which will be of any special value for general use. Notwithstanding this fact, a certain amount of general information will be of use to the operating engineer, and may serve as a guide in finding a remedy in special cases when the services of a chemist are not available.

Corrosion is a chemical action and may be both external and internal.

The first is due to dampness, either from leaky valves and fittings or other sources, and must be guarded against, particularly in the case of boilers having brick settings, as the moisture is held by the masonry in contact with the shell.

Internal corrosion acts in different ways, depending upon conditions.

General corrosion and pitting are caused by chemical action, due to certain ingredients in the feed-water. Grooving, so called, is brought about both by mechanical and chemical action, as noted later.

General corrosion or wasting is not readily detected, as it acts evenly over large areas and often attacks the rivet heads as well as the plates. Sometimes corrosion takes place only at the water-line or in a belt several inches in width along this point.

Pitting, as its name signifies, consists of corroded patches varying from one-half to ten or twelve inches in diameter. The cause of this is supposed to be the difference in the structure of the iron, thus rendering chemical action more rapid in some places than in others. Grooving is supposed to be caused by the springing of the plates, due to expansion and contraction, and its effect is increased by local corrosion. It is commonly found in the heads around the edge of the angle-iron stiffening pieces and also in the root of the angle itself. It is generally caused by staying the head too rigidly and by the unequal expansion of the shell and tubes. Excessive caulking along the edges of the seams will often cause external grooving, as it breaks the surface of the plates and exposes them to the corrosive action of the water.

Grooving is hard to detect as it appears only as a fine line or fracture, while it may extend into the metal for a consider able distance.

Incrustation, or hard scale, is due to an accumulation of sediment deposited in the boiler, either by precipitation or evaporation. This sediment, unless blown out frequently, is likely to harden and form scale.

The impurities most commonly found in feed-water are the carbonates of lime and magnesia, sulphate of lime, and chloride of magnesia. In some localities various salts of iron, carbonic and sulphuric acids and numerous organic substances are found.

The carbonates of lime and magnesia are held in solution by an excess of car-

bonic acid. Heating the water drives this off and causes the carbonates to be precipitated in the form of a light gray mud.

Increasing the temperature of the water makes the sediment less soluble until the boiling point is reached, where it becomes practically insoluble.

If the carbonates are comparatively free from other impurities, such as oil, organic matter, or sulphate of lime, they may be washed out of the boiler after it has been allowed to cool.

Brackish water containing chloride of magnesia is injurious, because when heated, the chloride decomposes, forming magnesia and hydrochloric acid which rapidly corrodes the plates. Sulphate of lime is precipitated when the temperature rises; precipitation being complete at about 280 degrees. This forms a hard scale which adheres firmly to the interior surfaces of the boiler, while the carbonates are soft and granular, and of a grayish color.

If the condensation from a heating system or a condenser is returned to the boilers, a small quantity of oil is likely to be brought back in spite of all precautions which may be taken to prevent it, and this mixed with other impurities which may be present forms a poor conductor of heat and is very likely to be the cause of burning or overheating of the plates. Overheating is generally due to a scum composed of the carbonates of lime and magnesia which floats at the surface of the water. If oil becomes mixed with this it offers a certain amount of resistance to the steam as it rises to the surface and allows in some cases a layer of steam to form next to the shell, which being a poor conductor of heat causes the plates to become greatly overheated when this occurs.

There are three general methods employed for preventing incrustation: first, by precipitating the scale-forming substances before the feed-water enters the boiler; second, by removing the sediment before it bcomes hardened; and third, by removing the hard scale from the interior of the boiler by mechanical means.

Feed-water may be freed of impurities to a considerable degree by allowing it to first pass through a purifier or open heater before being delivered to the boiler. As it mingles with the steam and becomes heated, the carbonic acid is driven off and the carbonates are deposited in the trays and upon the coke or other filter at the bottom of the heater.

Any organic impurities which float on the surface of the water are discharged through a surface blow-off. The simplest method of removing the impurities from a boiler after they have been precipitated is by blowing off a portion of the water. The heavier sediment is discharged from the lower part of the boiler or mud-drum through the pipes usually provided for this purpose, while the lighter particles which remain in suspension or float on the surface may be removed through the surface blow-off.

When soda-ash is added to water containing sulphate of lime, the lime and soda change their acids and form sulphate of soda, which is soluble, and carbonate of lime, which is precipitated and can be washed out.

Water containing salts of iron and free sulphuric acid are sucessfully treated with a mixture of lime and soda-ash. Soda-ash is also used in water containing chloride of magnesia, which calls for an alkali to neutralize the hydrochloric acid which is set free when the water is heated.

Carbonic acid and oxygen may be removed by heating the feed-water, and by the use of soda or slacked lime.

Water containing organic matter may be purified by precipitating with alum and filtering. Kerosene oil is used to some extent for the prevention and removal of scale. When used in the proper quantity it breaks up and loosens hard scale and prevents its formation.

It is best introduced drop by drop by means of an oil feeder, and only enough used to produce the desired effect, as an excess is likely to injure the interior surface of the engine cylinders. No definite directions can be given for the use of the various remedies mentioned, and the necessary amount in any case must be dedetermined by trial, or better, by a chemical analysis.

The formation of scale is less rapid in water-tube boilers than in fire-tube, owing to the more rapid circulation of the water in the former.

There are various ways of removing scale that has already formed. A safe method, but one which requires a good deal of time, is to chip it off with suitable tools. This, however, becomes difficult when the scale is hard or the construction of the boiler is complicated, and one of the many forms of mechanical cleaners now on the market will probably be found the most satisfactory.

Electrical Fire Apparatus.

Consul S. P. Warner reports that the Leipzig fire department has purchased and put into use at the principal fire-engine station four electrical machines, *i. e.*, engine, ladder truck, and two tenders, of which he gives the following particulars:

One of the tenders is used exclusively for trials and for training the members of the fire company in the use of the machines. The principal advantage claimed for the new machines is that they are always ready to start for a fire the instant an alarm is sounded. They also do away with the necessity of keeping a number of horses, and thus materially reduce the contingent expenses of the fire department.

The electrical power for running the machines is stored in accumulators. Owing to the quantity of lead employed in the construction of these accumulators, the machines are all very heavy, their weights varying from five to six tons. All of the machines are driven from the front axles, so that it is possible to turn them even in the narrowest streets. Each machine is equipped with two motors, which can develop from seven to fourteen horse-power. They have five forward and two backward speeds and one electrical and one hand-brake. The machines are guaranteed to run a distance of 18.5 miles on one charge at a rate of speed of 15.5 miles per hour, even upon poorly paved streets or upon four per cent inclines. As there are no hills in Leipzig and as the streets are all in good condition, the machines can cover a distance of about twenty-four miles on one charge.

The crews for the various machines are as follows: engine, two machinists, two drivers, and one fireman; tender, one director, two drivers, and five firemen; and ladder truck, one director, two drivers, and three firemen. The length of the extension ladder, which can be raised either by a carbonic-acid motor or by hand-power, is eighty-six feet. About twenty-five seconds are required to raise the ladder by motor and about one minute and a half by hand-power. The engine, which is built upon the three-cylinder system, has a pumping capacity of 320 gallons of water per minute. It carries a tank containing eighty gallons of water, which, by means of a compressed-gas apparatus, can be thrown upon a fire immediately upon the arrival of the engine. It requires about nine minutes for the engine to generate five atmospheres of steam.

Leipzig is said to be the only city in Germany which has a fire company completely equipped with electrical machines.

Company Incorporated to Distribute Power from McCalls Ferry.

An undertaking which, it is hoped, will revolutionize electrical power in Baltimore, Md., and mean the saving of thousands of dollars to users of electricity, is well under way by a party of Baltimore capitalists. The plan is to bring electricity into Baltimore by means of overhead wires from the Susquehanna river at McCall's Ferry. Wire supported by towers to be placed at intervals of from 500 to 1,500 feet apart will be stretched along a highway 100 feet wide for forty miles to the Susquehanna. With this end in view the Pole Line Company was incorporated at Towson. The incorporators are George R. Willis, Alexander McCormick, Thomas B. Gatch, Charles W. Kennerd and John T. Murphy.

It is stated by Mr. Willis that the company would be ready for business by June 1, 1908.

The United Railways and Electric Company has executed a contract with the McCall's Ferry Power Company by which the latter will furnish electric current for the railways here as soon as its plant is completed.

The United proposes using the electric current generated by the river as an adjunct to its city power-houses. The Consolidated Gas, Electric Light and Power Company recently made a contract with the McCall's Ferry Company for the exclusive use in this territory of all the river current with the exception of that required by the United.

The "Telemagnophone."

The American Callaphone Company, New York city, has installed at the Grand Central Station of the New York Central & Hudson River Railroad in New York city a new instrument called the "Telemagnophone," for announcing the departure of trains from the station. Large brass horns are located in different parts of the waiting room, making the announcements simultaneously.

The "Telemagnophone" is a combination of electrical devices. Connection is made by an ordinary copper wire from the transmitting station, charged with a small battery current. The transmitting horns are mounted either singly or in duplicate or in triplicate on each side of the instrument. The system is the original invention of L. J. Lippmann, and has been worked out by A. G. Kaufman.

The Convention of the National Electrical Contractors' Association.

The arrangements for the seventh annual convention of the National Electrical Contractors' Association, which will be held in New York city, July 17, 18 and 19, have been completed, and it is expected that one of the largest and most successful meetings in the history of the association will be held at that time. The sessions will be held in the Engineering Societies Building, 29 West Thirty-ninth street, in assembly room No. 1 on the fifth floor. The Imperial Hotel, Broadway and Thirty-first street, will be association headquarters. The following programme has been arranged:

JAMES R. STRONG, PRESIDENT NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

W. H. MORTON, SECRETARY NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

July 17—10 A. M., open session; 2 P. M., executive session.

July 18—10 A. M., open session; 2 P. M., executive session; executive session in the evening if necessary.

July 19—All-day outing.

At the open sessions every one interested in the electrical business is welcome, and from the list of speakers which has already been announced it is certain that a most interesting and instructive opportunity will be afforded.

The entertainment committee has prepared a programme for the ladies, members and guests, some of the principal features being as follows: On Wednesday there will be a boat trip entirely around Manhattan Island, and in the evening the annual dinner will be held at the Waldorf-Astoria. The dinner will be followed by an amateur vaudeville and theatrical performance given by members of the association. On Thursday there will be an automobile trip to Coney Island, where dinner will be served, returning to New York in the evening. This trip will be for the ladies. For the members there will be a smoker at Shanley's, including entertainment features, after the evening session. On Friday the members, ladies and other guests will be given a boat trip on Long Island Sound. A baseball game between the eastern and western members of the National association is scheduled. After the ball game there will be a clambake and other entertainment features.

The regular nominations for officers of the National Electrical Contractors' Association for 1907-1908 are as follows: President, James R. Strong, New York city; first vice-president, L. L. Sanford, Minneapolis, Minn.; second vice-president, Charles R. Kreider, Chicago, Ill.; third vice-president, F. C. Werke, Cleveland, Ohio; treasurer, John R. Galloway, Washington, D. C.; secretary, W. H. Morton, Utica, N. Y.; sergeant-at-arms, J. C. Sterns, Buffalo, N. Y. There is one opposition nomination, that of F. E. Newbery, St. Louis, Mo., for first vice-president.

Telephones in France.

Victor M. Berthold, in *New England Telephone Topics*, takes up the study of telephone conditions in France. Since 1890 the telephone has been the monopoly of the state. Prior thereto a corporation called the Société Generale des Telephones furnished service in several of the large cities. At the time the postal telegraph administration took over the property of the corporation Paris had 6,504 telephone stations. At present the metropolis has about 59,000 stations, or one to each forty-six inhabitants.

There is apparently an utter lack of discipline among the operators, as well as considerable ignorance on the part of those in charge of the service of modern telephone problems. The French government appears unwilling to appropriate the means necessary for building up a first-class telephone service. The interruptions on toll lines are many, and often of long duration.

WIRING PLANS FOR HEATING APPLIANCES.

BY F. M. FEIKER.

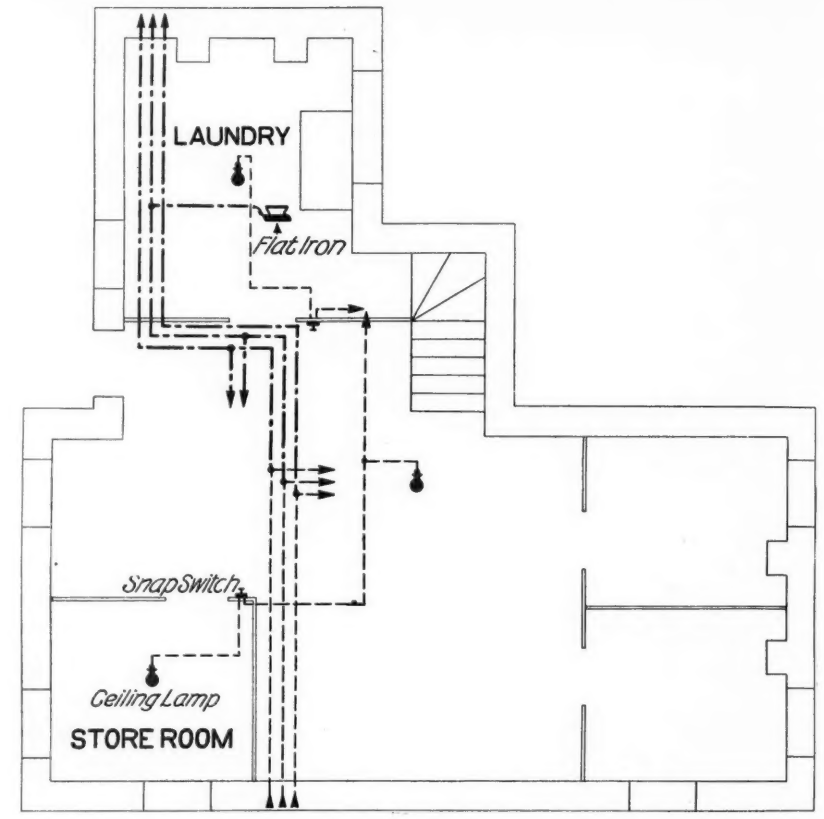
In the issue of the ELECTRICAL REVIEW for June 1, attention was called to some general aspects of wiring for electrical heating appliances and details were given of the wiring plans for a $10,000 house. These plans involved the use of a number of separate electrical heating circuits as well as the utilization of the regular lighting circuits for heating devices. As outlined in the previous article, the logical step in planning for a house of less first cost, say $5,000 or $7,000, is to install a single heating circuit and to make a general but somewhat less extensive use of the lighting circuit, fixing the amount of money invested for wiring as a percentage cost of the house.

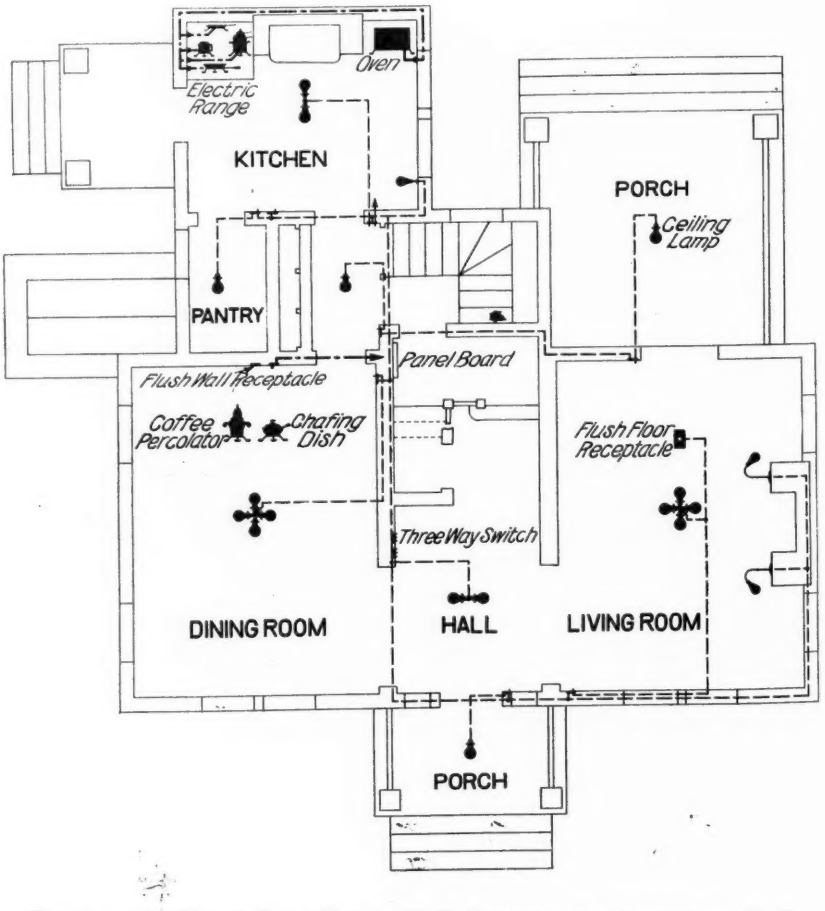
In the case of the house-owner who does not care to elaborate the electrical circuits in his home, attention should be

FIG. 1.—RECEPTACLE INSTALLED UNDER BRACKET IN BATHROOM.

given to the possibilities of the lighting circuit. There are now on the market a great number of heating appliances which absorb such small amounts of energy that they can be used readily on the lighting circuit. These appliances include the coffee percolator, chafing dish, heating pad, small water heater, cigar lighter and many other miscellaneous devices. By adapting to the lighting circuit these smaller devices not only is the cost of wiring decreased, but the convenience and cleanliness of the electrical system is still realized.

The location of the outlets for the heating appliances is not of the least importance. For many purposes, the flush receptacle in the baseboard of the room answers many requirements. In other places, for instance, a receptacle placed beneath the bracket-lamp in the bathroom (see Fig. 1) upon the same circuit as the lamp, is very convenient as a connection for the electric shaving mug or the massage motor. Similarly, a suitable outlet placed





FIGS. 2 AND 3.—WIRING PLAN, HOME OF F. R. SCHOONMAKER, SCHENECTADY, N. Y.

near the head of the bed is most convenient for the use of a heating pad, as it does not necessitate unscrewing a lamp at night.

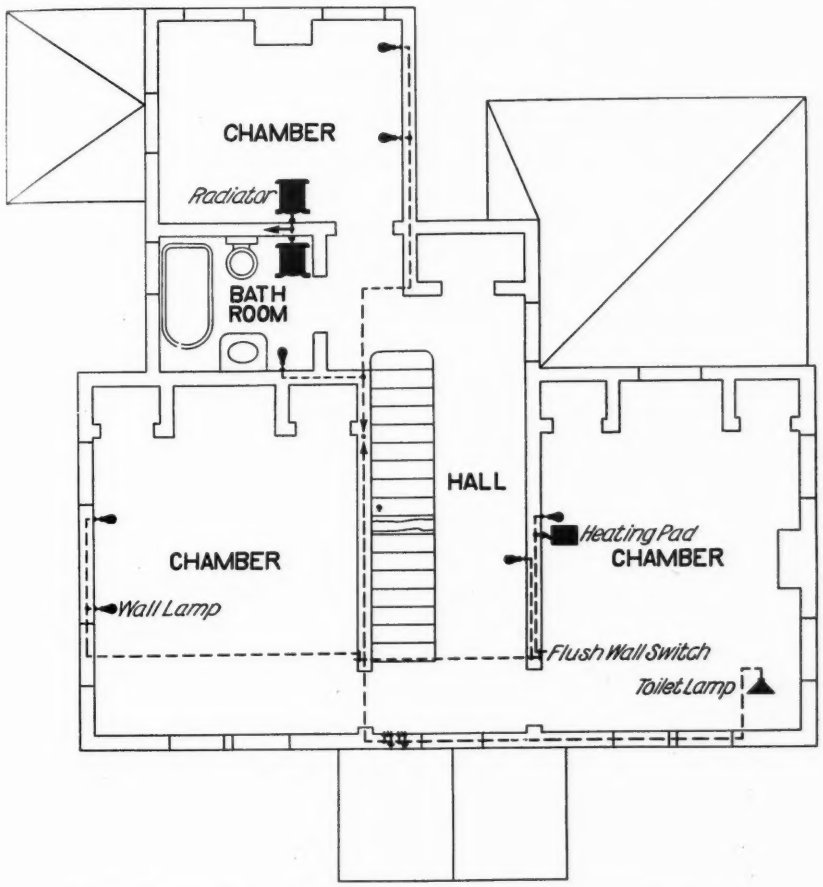


FIG. 4.—WIRING PLAN, HOME OF F. R. SCHOONMAKER, SCHENECTADY, N. Y.

WIRING FOR A $5,000 TO $7,000 HOUSE.

In the plans of F. R. Schoonmaker's house at Schenectady, N. Y., (Figs. 2, 3, 4), many of the points suggested have been carried out. This house illustrates the use of a single electric heating circuit with a restricted use of the lighting circuits for heating purposes.

FIG. 5.—FLUSH RECEPTACLE AND PLUG FOR LARGE HEATING DEVICES.

As can be seen in the basement plan the main supply circuit enters the basement and from this the heating circuit and lighting circuits branch, as shown by the arrows. The heating circuit runs direct to the basement laundry, a branch running to the flat-iron. Connections are made with the kitchen on the first floor and with the dining room by branch circuits running through the partitions to the respective rooms. The heating circuit at the dining room is provided with flush wall receptacles, to which connection is made for the chafing dish and percolator.

In the kitchen the electric baking outfit is arranged as shown. This electric outfit is used for auxiliary cooking, much as a gas range would be, and the oven, placed by itself on the opposite side of the coal range, is controlled from the main table.

Upstairs the heating circuit upon which the dining room appliances are operated is extended to supply current to the electric luminous radiator, either in the chamber or bathroom.

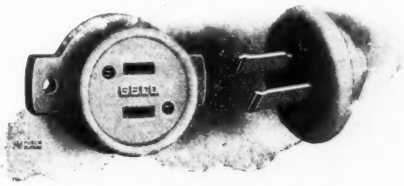


FIG. 6.—RECEPTACLE AND PLUG FOR COOKING OUTFITS.

The arrangements for the lighting circuits are shown in the plans. Landing and basement lights are controlled by three-way switches to make them most convenient. In the living room a flush-floor receptacle is installed so that the reading lamp, chafing dish or coffee percolator can be operated without necessitating the use of a long cord.

FIG. 7.—RECEPTACLE FOR MOLDING WIRING IN OLD HOUSES.

FIG. 8.—A FIVE-AMPERE INDICATING SWITCH

A few of the electrical outlets suitable for the purposes mentioned are illustrated. In the house where several heating circuits are used it is essential that an appliance taking a large current be not placed on the regular lighting circuit. To guard against this possibility a receptacle and plug (see Fig. 5) make the

FIG. 9.—A SEPARABLE COVER ATTACHING PLUG.

FIG. 10.—A FLUSH PLATE PLUG RECEPTACLE.

lighting circuits safe from misuse for a large electric air heater. All appliances having cords terminating with this plug can be used only on receptacles made to fit them. For similar reasons the receptacle and plug shown in Fig. 6 are useful in connecting up electric radiators or cooking outfits. Where "two heats" are available, this receptacle can also be obtained with three poles. The remaining illustrations (Figs. 7, 8, 9, 10) are typical of various fittings of which good use can be made in wiring for heating appliances.

FOR HOUSES COSTING LESS THAN $5,000.

From what has been said it is easily seen that for the simplest and least expensive system of wiring for heating devices only the lighting circuit need be used. The suggestions embodied in the description of Mr. Schoonmaker's house hold with the same force in a house of less cost in which it would seem inadvisable to install any heating circuit on the percentage cost basis allowed for the wiring. By an elimination of the non-essentials in a small cottage, however, and by a careful arrangement of suitable outlets, the advantages of the flexible electric current can be impressed upon the householder without substantially increasing the cost of the wiring. Bedrooms, for instance, lighted by bracket lamps with a chain-pull socket are nearly if not quite as convenient as chambers in which a switch-controlled chandelier is used. The saving in cost of wiring and fixtures by means of this substitution will easily pay for the cost of an extra outlet or two for the heating pad, milk-bottle warmer, and other small electrical appliances which add much to domestic comfort.

If possible, the heating circuit to the kitchen should be installed, for in every home electricity is bound to become a source of heat energy for domestic purposes. The cost of such a circuit when the light wiring is being done is nominal. But if the expenditure incident to such a heating circuit is out of proportion to the total cost for electric wiring, at least, extra receptacles should be installed on the lighting circuit. This procedure will benefit alike the contractor, the central station manager and the owner; for the first will reap the benefit of the additional investment, however slight; the second will sell more current because of the tendency on the part of the consumer to take advantage of the thorough convenience of the electrical circuits and use more current, while the consumer will be content with his increased bill because he is satisfied that he is getting his money's worth.

Municipal Electric Light Plant for Franklin, La.

A contract has just been let to Muralt & Company, engineers, of 114 Liberty street, New York city, for a complete modern municipal electric light plant for the town of Franklin, La. This town is one of the oldest settlements in that part of the country. At the same time the town is distinctly progressing along modern industrial lines, and in addition to having lately installed an extensive central market building it has now just passed the above-mentioned contract for an electric light plant. The latter will be of sufficient capacity to furnish electric light to the 4,000 or more inhabitants and electric power to several saw mills and sugar refineries. In addition there will be a street lighting system of twenty-five arc lights and forty incandescents.

The power-house will contain the most approved type of machinery in every respect, Heine safety boilers, Harrisburg engines and Fort Wayne electric apparatus being used. The contract calls for getting out the machinery in three months and the complete plant is expected to be in operation early the coming fall.

Mayor J. C. Lewis, of Franklin, was the moving spirit in getting this plant, and he was unanimously and enthusiastically backed up by the Franklin council. The plans and specifications were prepared by Warren B. Reed, the well-known consulting engineer of New Orleans. The complete contract, as already stated, is in the hands of Muralt & Company of New York.

Mexican Light and Power Company Makes Extensive Additions to Equipment.

The Mexican Light and Power Company, which has contracted with the street railway company of Mexico City to supply 5,000 horse-power for operating the tramway, has recently ordered 8,000 horse-power capacity of transformers to come from the works of the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., of G. & O. Braniff and Company, the representatives for the republic. These transformers will be divided into six units of 1,000 kilowatts each, the transformer being single phase.

The energy is transmitted to Mexico City from Necaxa at 60,000 volts, which passing through transformers is reduced to 20,000 volts at the power company's Nonoalco substation. At this voltage the energy is distributed to five different substations located at different parts of the city, Churubusco, Alameda, Indianilla, etc.

These new transformers will reduce the voltage received at 20,000 to approximately 3,000 volts for the motor-generator sets in these respective substations, the motor-generator sets being used to change the alternating current to direct current for the trolley circuits at approximately 600 volts. A part of this additional transformer capacity will be also used by the power company for lighting and power service in the vicinity of the districts where they are installed.

The Machinery Club, New York City.

The Machinery Club, of New York city, has been organized for the purpose of providing a pleasant place of common resort for entertainment in the heart of the business section of Manhattan, conveniently located to most of the offices of the concerns interested in the various branches of the machinery and metal trades. Quarters have been engaged on the twentieth and twenty-first, and possibly on the nineteenth floors of the Fulton Terminal Building, on Church street, New York city. The club will primarily be a lunching club, but it is expected that the appointments and convenient location will make it a general rendezvous for the machinery trade of New York city.

The officers are: president, F. H. Stillman, president Watson-Stillman Company; vice-president, R. I. McKinney, president Niles-Bement-Pond Company; treasurer, Walter L. Pierce, secretary and general manager Lidgerwood Manufacturing Company; secretary, Theodore Waters.

Navy Department Purchases.

The United States Navy Department, Bureau of Supplies and Accounts, will open bids in Washington, D. C., July 16, 23 and 30 for the following material: 12,700 feet electric conductor for League Island, Pa.; 8,950 braided rubber-covered conductor, Charleston, S. C.; 5,400 feet enameled conduit, Charleston, S. C.; 4,900 feet steel conduit, League Island, Pa.; 770 couplings, Charleston, S. C.; miscellaneous electric fixtures, New Orleans, La.; one motor-drive outfit for a lathe and one motor-drive outfit for a drill, Charleston, S. C.; sixty-five pounds pipe straps, League Island, Pa.; 1,225 pipe straps, Charleston, S. C.; 100 brass unions, Charleston, S. C.

Wireless Telegraphy—Some of its Practical and Commercial Aspects.[1]

By William Maver, Jr.

PART I—TECHNICAL ASPECTS.

WIRELESS telegraphy now appears to be settling down on a practical basis. It is finding its important field to be where all those who have not been actuated by interested motives have consistently stated it would be found—namely, as a means of communication between ships at sea and between ships and the shore. How long it will hold this field undisputedly depends upon the measure of success that may attend the efforts of those who are now endeavoring to perfect wireless telephony. At least half a dozen inventors are at work on this problem in this country and Europe, and it is reported that the wireless transmission of speech has been experimentally successful up to distances of several miles over land; but apparently much remains yet to be done before wireless telephony, even for short distances, becomes an accomplished fact. Should this hoped-for result be achieved, however, it is evident that for many purposes it will displace wireless telegraphy. For example, probably one of the chief reasons why wireless telegraphy is not already universally installed on all manner of sailing vessels and steamships is the necessity for employing an expert Morse operator to transmit and receive messages. Wireless telephony, even if only available for a comparatively short distance, obviously could be installed to advantage in the officer's room of every ship that floats the ocean, lake, river or harbor, and perhaps on railway trains as well, for any purpose that might arise.

Wireless telephony is not yet here, however, while fortunately for those that go down to the sea in ships, wireless telegraphy is here, and it is already installed or is being installed on every lighthouse and on the vessels of every important navy and steamship line in the world. It is probably easily within bounds of accuracy to say that there are now over 2,000 wireless stations, including ship and shore stations, in operation in various parts of the world, and this number is being added to daily.

The distances covered by wireless telegraphy in regular operation may be set at from one mile to fifty or 100 miles. When the statement is made, as it frequently has been, that messages have been received from ocean-going vessels several days out from New York, it may be taken for granted that these messages have been received at one or other of the Atlantic coast stations within wireless signaling distance of the vessel, and by those stations repeated by overland wire telegraphy to New York. There is no doubt that messages are received under favorable conditions at distances of several hundred miles away from shore, but these are exceptional cases. No regular interchange of business is at present carried on at those distances.

While we frequently run across the statements of interested brokers in wireless-telegraph stock that transatlantic wireless telegraphy will shortly be accomplished, it is noticeable that Marconi, Fessenden and De Forest have of late been silent on this subject. Fessenden indeed has, with commendable frankness, practically admitted that the difficulties of transatlantic wireless telegraphy are at present well-nigh insurmountable. His experiments were continued for nearly one year between Massachusetts and Scotland. He found that there are at least two serious obstacles in the way of transatlantic wireless signaling. First, atmospheric absorption of the electric-wave energy of the signals. Up to distances of 1,000 miles this absorption is not very marked, but beyond this point it becomes very important. The other difficulty consists in the inability to maintain syntony, or tuning of the apparatus, at the respective transmitting and receiving stations. The difficulty, in the words of Mr. Fessenden, "is in getting the stations which are to communicate to maintain their frequencies sufficiently regularly." It was found impossible to receive messages when the frequency varied one part in 1,000,000. This, it may be noted, is equivalent to saying that if a telegraph system which depended for its successful operation upon the synchronism of wheels at the sending and receiving stations should vary one part in 1,000,000 the system would not operate. While Mr. Fessenden is hopeful that these difficulties will be overcome, the prospect for an immediate realization of this hope is not very encouraging. But fortunately, again, there is no real necessity for transatlantic wireless telegraphy, or cableless telegraphy, as some wireless experts take pleasure in terming it. The Atlantic cables are still doing business at the old stand, and there is every reason to believe that they will continue to do so for many years. Singular as it may seem to some people there is, apart from occasional injury to the cables, no method of telegraphing that is as reliable as submarine-cable telegraphy. The reasons for this are obvious. The cable, year in and year out, works undisturbed by changes in weather conditions. Lightning storms do not affect its operation, and vagrant currents from neighboring and unneighborly electric-traction circuits, or induction from high-tension alternating-current systems, can never approach within harmful distance of its sensitive apparatus. Similar immunity from these disturbing factors in overland telegraphy would, there is no doubt, be gladly welcomed by the members of this association.

Apart from the filings coherer it may be said that the most prominent type of detectors now in use are the magnetic detector employed by the Marconi interests, the carborundum detector employed by the De Forest company and the various electrolytic detectors of the Fessenden and Shoemaker types. The magnetic detector, the carborundum detector and the electrolytic detector require a telephone receiver for the reception of signals. The magnetic detector was described in the author's paper on "Improvements in Wireless Telegraphy," read before the Indianapolis convention of this association. The carborundum detector consists of a crystal of carborundum which is clamped between two metal electrodes. Otherwise, so far as the arrangement of circuits is concerned, it simply displaces the filings coherer, but does not operate a relay. The electrolytic detector consists of a small cup containing a dilute solution of nitric acid, into which the terminal of a very fine platinum wire is placed. Another wire enters the acid from the bottom of the cup. When current from a small dry battery is passed through the solution by means of the fine wire, polarization takes place and current ceases to flow in the circuit. Incoming electric waves appear to dissipate this polarization, causing

[1] A paper read at the convention of the Association of Railway Telegraph Superintendents, Atlantic City, N. J., June 19-21.

variations in the current of the local circuit, and sounds corresponding to dots and dashes are heard in the telephone receiver.

The De Forest "audion" is also one of the more recently invented wireless detectors. This detector, briefly described, consists of an incandescent filament in a vacuum, shunted by a local circuit in which is a battery and a telephone receiver. Incoming electric oscillations appear to affect the electrical condition or equilibrium of this circuit and set up variations of current therein which are heard as dots and dashes in the telephone receiver. This receiver was fully described in the transactions of the American Institute of Electrical Engineers for 1906.

Another detector which promises to be of utility in practical wireless telegraphy is the silicon detector, the invention of G. W. Pickard. This detector is of the thermoelectric type of wireless receivers. It produces its own electromotive force. Its electrodes are pure silicon and a metallic element of low resistance. The energy of the incoming electric oscillations are converted into joulean heat (C^2R) at the element having high resistance (the silicon), which heat is converted at the contact point into a short pulse of direct current in the telephone receiver; and a long or short continuation of these pulses produces a dash or dot in the receiver. Mr. Pickard states that a fragment of silicon merely held with suitable pressure between two flat-ended brass rods gives excellent commercial results. This detector has the advantage that no battery is required in the local circuit. In sensitiveness it compares favorably with the electrolytic and magnetic detectors, according to tests made by Mr. Pickard. The carborundum detector is about one-half as sensitive as the last-named detectors.

It is interesting to note that the telephone receiver has been found to respond to a single impulse of current of very much less strength than is required to energize the most sensitive wireless detector, and were it not for the high inductance of the telephone receiver, the intermediate wireless detector would not be necessary. At the high frequencies used in wireless telegraphy, however, namely, of the order of 500,000 or 1,000,000 per second, the inductance of the telephone receiver renders it mute.

An improvement in wireless telegraphy that may lead to important results consists in the use of undamped oscillations, with which numerous experiments are now being made by Poulsen, Shoemaker, the Telefunken company and others.

In the ordinary "spark" gap transmitter, it is known that between each spark or train of sparks there is a rapid falling off or damping of the amplitude of oscillations; consequently the full benefits of resonance in the tuned receiving circuits are not obtainable. Poulsen's method of obtaining undamped oscillations is an amplification of the Duddell "singing arc" and consists in employing an electric arc of peculiar construction shunted with a capacity (condenser) and inductance of a wireless transmitting circuit.

In Poulsen's device the positive electrode is copper, the negative electrode is carbon. When the capacity and inductance are suitably adjusted, rapid oscillations of uniform amplitude are established in the circuit and thence are thrown upon the vertical wire. These oscillations are broken into dots and dashes in the usual way. Unfortunately, thus far the energy output by this method is low, and it remains to be ascertained whether or not the advantages of uniform amplitude by conducing to a better utilization of resonance will more than offset the disadvantage of reduced energy output.

Another improvement in the practice of wireless telegraphy consists in the employment of electric-wave meters by means of which the wave-length or the wave frequency may be measured. These wave meters are based primarily on the principle that with an exciting circuit in proximity to a secondary circuit, a maximum current will be induced in the secondary circuit when the two circuits are in resonance, which will be when they possess corresponding inductance and capacity. Knowing the capacity and inductance of the secondary circuit, the frequency and wave-length of the oscillations are deducible. (A detailed description of electric-wave meters may be found by those interested in the last edition of the author's work, "Wireless Telegraphy.") Increased familiarity of the operators with the apparatus has also naturally tended to improved results in the actual operation of the various systems. Apart from the foregoing noted features and certain improvements in the details of apparatus and the arrangement of vertical wires, there has been comparatively little advance made in the art of wireless telegraphy during the past one or two years.

A short description of some experiments conducted recently by the Telefunken Wireless Telegraph Company of Berlin, relating to the use of wireless telegraphy between railway trains in motion and fixed stations, may be of interest to the members of this association. The experiments were made on sections of railway track about 12.5 miles in length, with four stations about four miles apart within this distance. The wireless outfit of each fixed and moving station consisted of a filings coherer receiver and an induction coil transmitter, together with the other apparatus usually employed therewith. A coach containing the wireless outfit was equipped with a rectangular wire suspended by posts about one foot high at each corner of the roof of the coach. The wire was attached to porcelain insulators on the top of these posts. A single wire was led from this wire to the apparatus within the coach. A ground was obtained through the iron trucks of the coach. The fixed station was between the telegraph poles. The aerial wire was erected horizontally between the poles and paralleled the regular telegraph wires for a distance of 195 feet, about one foot therefrom, and was carefully insulated from those wires. A wire connected this aerial wire to the apparatus in the fixed station. The ground was made by a wire connection to the nearby rails. Current for the induction coil was supplied by eight portable storage cells giving sixteen volts and having an output of about five amperes with a spark-gap of 0.12 inch. The maximum distance of the train from the tracks was sixty-five feet.

By this arrangement reliable signals were sent and received at a distance of 7.5 miles.

As several of the members of this association have had experience with other methods of telegraphing to and from moving trains, they can probably enlighten the association as to the necessity of improvements over those methods, and also as to the utility of such systems in general.

PART II—COMMERCIAL ASPECTS.

The opinion of the writer has been frequently asked as to the merits of the great claims that are being made relative to the dividend-earning capacity of wireless telegraphy by the brokers who appear to have assumed control of the stock-selling end of one or more of the wireless companies. A few remarks bearing on these claims may, therefore, not be inappropriate at this time.

Let us first discuss the wireless telegraph earnings on the basis of the exchange of messages between ship and shore

stations. According to the published reports of one of the wireless companies which has its system installed on seventy-eight steamships plying between Europe and the United States, the gross earnings for the year 1906 were approximately $55,170 for messages exchanged between ship and shore stations. This figures out to approximately 25,823 messages for the year, which is equal to a total of seventy messages per day, of less than one message per day per ship. How much, if any, of this revenue goes to the foreign wireless telegraph company that presumably owns the wireless apparatus on the ships is not stated. Presumably also certain royalties may have to be paid by the ship owners for the use of the apparatus, and there may also be additional revenue for "news" service received on shipboard. But granting this, it is difficult to figure out much net revenue after the salaries of officers and operators have been paid.

This is perhaps the best showing that can be made for wireless telegraph companies doing a general commercial business in this country, or with the ships that sail United States waters. When it is stated that hundreds of steamships own their own wireless apparatus outright, and do considerable business with government wireless shore stations without charge, the difficulty of seeing a bright prospect for the earning of dividends on capitalizations amounting to six, eight or ten millions of dollars by a legitimate exchange of wireless messages between ship and shore stations is largely increased.

One of the large German wireless telegraph companies has confined its business almost exclusively to the manufacture and sale of its apparatus outright to customers, and it is understood they have made fair profits. Several companies in this country are doing likewise. Obviously, therefore, there is no monopoly of this art on the part of any one company, although such a claimed monopoly is the chief stock-in-trade of certain of the stockbrokers referred to.

An analysis of the published claims put forth by certain stockbrokers to induce the purchase of stock in a wireless telegraph company shows some glaring misstatements, seemingly at least calculated to mislead prospective customers as to the constructional and operating costs, etc., of the system. Another method to induce purchase of stock consists or did consist of sending broadcast by mail circular letters offering stock of a wireless telegraph company at $110 per share, guaranteeing five per cent per annum on the stock for five years. This appears a fair enough proposition until it is known that the stock was at the time offered on the New York curb at $30 to $36 per share. This offer was accompanied by the most glowing accounts, without regard to the difficulties in the way, of the prospective earnings of the company, by means of transatlantic wireless telegraphy and by overland wireless telegraphy as well. It is but fair to say that the managers of at least one of the companies whose stock is being used in this way has disclaimed any responsibility in the matter. Unfortunately, it is to be feared that the brokers were only too successful in unloading stock to unsophisticated purchasers on this basis.

The author of this paper has frequently taken occasion to express his admiration for wireless telegraphy as an art and to point out its extreme importance in the field for which it is so well adapted. It should be, however, he believes, as much the duty of one more or less familiar with the facts to point out, when opportunity offers, the limitations of a system, and the erroneous and seemingly misleading claims made in its behalf, as to laud its merits and advantages. This constitutes the reason for the writing of the second section of this paper.

Standard Symbols for Electrical Plans.

To the Editor of the Electrical Review:

Great credit is due the National Electrical Contractors' Association for the steps it has taken to draw up a standard set of electrical symbols, particularly suitable for wiring plans.

This subject is, however, not confined to contractors, but involves illuminating engineers, electrical engineers, consulting engineers in general, and architects, and influences more or less the other building construction branches; yet it is somewhat regrettable to find that this association has been carrying the burden alone.

As regards the general appearance of the symbols, much can be said, but to the layman, they do not appear at all simple to remember, whilst although there is a suggestion that some were included in order to meet every case, other apparati of common occurrence and importance were not included.

Double circles, squares with ears, and polygons enclosing hieroglyphics may mean a lot, but they take time and too much effort to construct, and even suggest that almost forgotten art the aborigines used for transmitting messages.

In fact it seems as if a very much simpler code could be devised, simpler for the draftsman, simpler for the electrician, and simpler for the public, and more satisfactory to all concerned.

Many of the outlets could be just as well represented by a circle with a particular letter inside, such as T for telephone, B for bell, etc., and it would appear that instead of an "S" by itself we could put it in a circle also, taking care of special conditions in the specifications, or by a descriptive note on the drawing itself, which would tend to be more explanatory, and perhaps avoid the necessity of carrying a manual of the symbols in one's pocket.

In regard to lines for "conduits," "wires," etc., it is necessary that a certain amount of consultation should take place in conjunction with steam piping men, plumbers, and other kindred branches which have pipes to show on perhaps the same drawings.

Then, as special apparatus is apt to spring up at a later date, which would not necessarily concern the contractors, it would seem advisable that some steps should be taken to have such events anticipated, and this is best done by selecting some channel which can be recognized as an authority for everybody and also tend to give a more logical conclusion to any decisions arrived at.

The National Electrical Contractors' Association has shown good judgment in the past, particularly in regard to rules governing the contractor, and should be persuaded to take this matter up in cooperation with the contractor and others concerned, and it would seem consistent for them to consider and develop the entire system of electrical symbols appropriate to all the branches of electrical engineering.

These matters have to be taken up sooner or later by all concerned, and are more satisfactorily dealt with the earlier they are attacked, and it should be the aim of every class of engineers, architects, contractors, etc., to cooperate in this subject as soon as possible, and make the accumulated result of their experience and ability produce a standard set of symbols which would be as nearly perfect as material effort can attain.

A. P. C.

Washington, D. C., June 22.

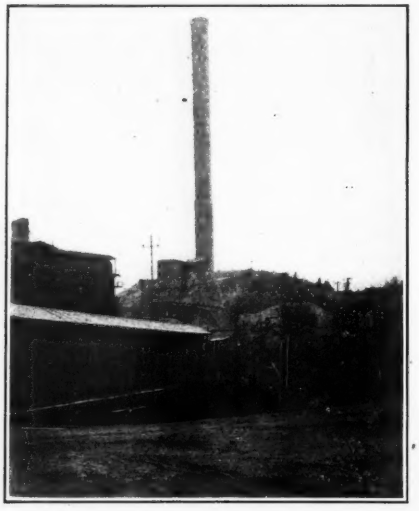
An electric smelter has been started up at Heroult, on Pitt River, about eighteen miles from Redding, Cal. The smelter cost, it is stated, $70,000, and uses current to the extent of 2,000 horse-power.

The Electrolytic Reduction of Low-Grade Ores.

By Day Allen Willey.

THE enormous quantity of low-grade ores in America containing not only copper and lead, but gold and silver, has caused the invention of apparatus in connection with the smelting processes which is notable for its economy and efficiency. Mineralogists and other experts are authority for the statements that the Pacific Northwest, as well as Mexico, British Columbia and Alaska, contain many beds of ores at present undeveloped for the reason that the percentage of pure metal they contain is so small that it is not worth while to extract it by the processes used in the majority of smelters.

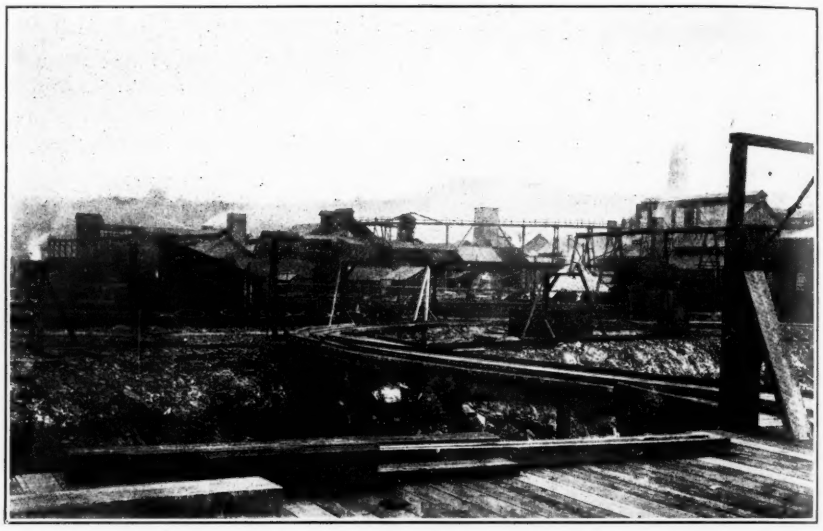
The application of the electric current in recent years, especially in electrolytic



General View of the Works of the Tacoma Smelting and Refining Company.

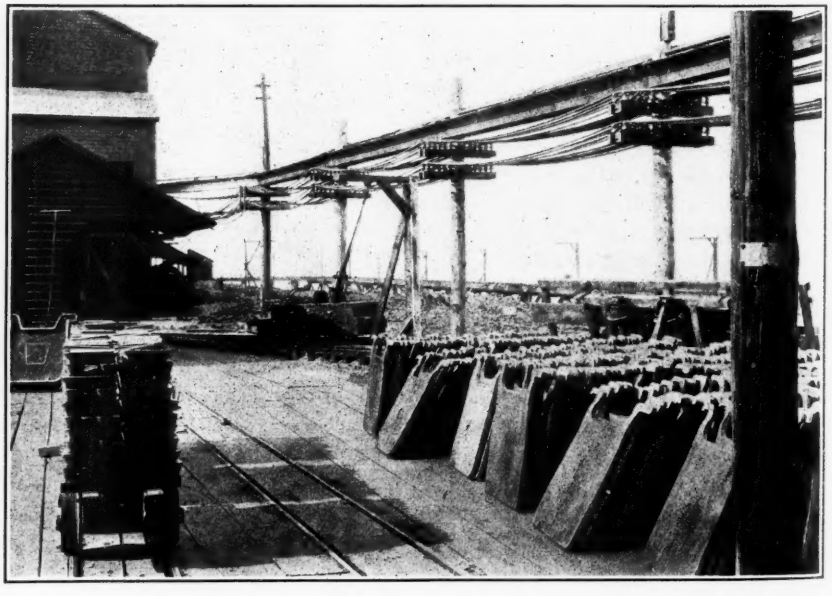
work, however, has proved that it is possible to make much of this ore of commercial value, for smelters have recently been erected in this country by which the cost of refining copper has actually been reduced from an average expense of twenty dollars for each ton of metal to only eight dollars per ton.

The smelter which has recently been completed at Tacoma, Washington, for the Tacoma Smelting and Refining Company, contains what is probably the most modern devices in this country for metal extraction. It not only treats copper, but lead ores, with such success that concentrates containing less than one per cent of pure metal can be profitably worked. Securing material from the mines of British Columbia, Alaska, California, Oregon, Mexico, as well as Central and South America and Europe, over thirty varieties are roasted in the Tacoma smelter, the charge at times including a blend of five or six different grades. The skill in mixing the ores is one reason why it is profitable to extract the metal from very low grades, but the various processes employed are notable for their economy.



General View of Works, Showing Electric Tramway, Tacoma Smelting and Refining Company.

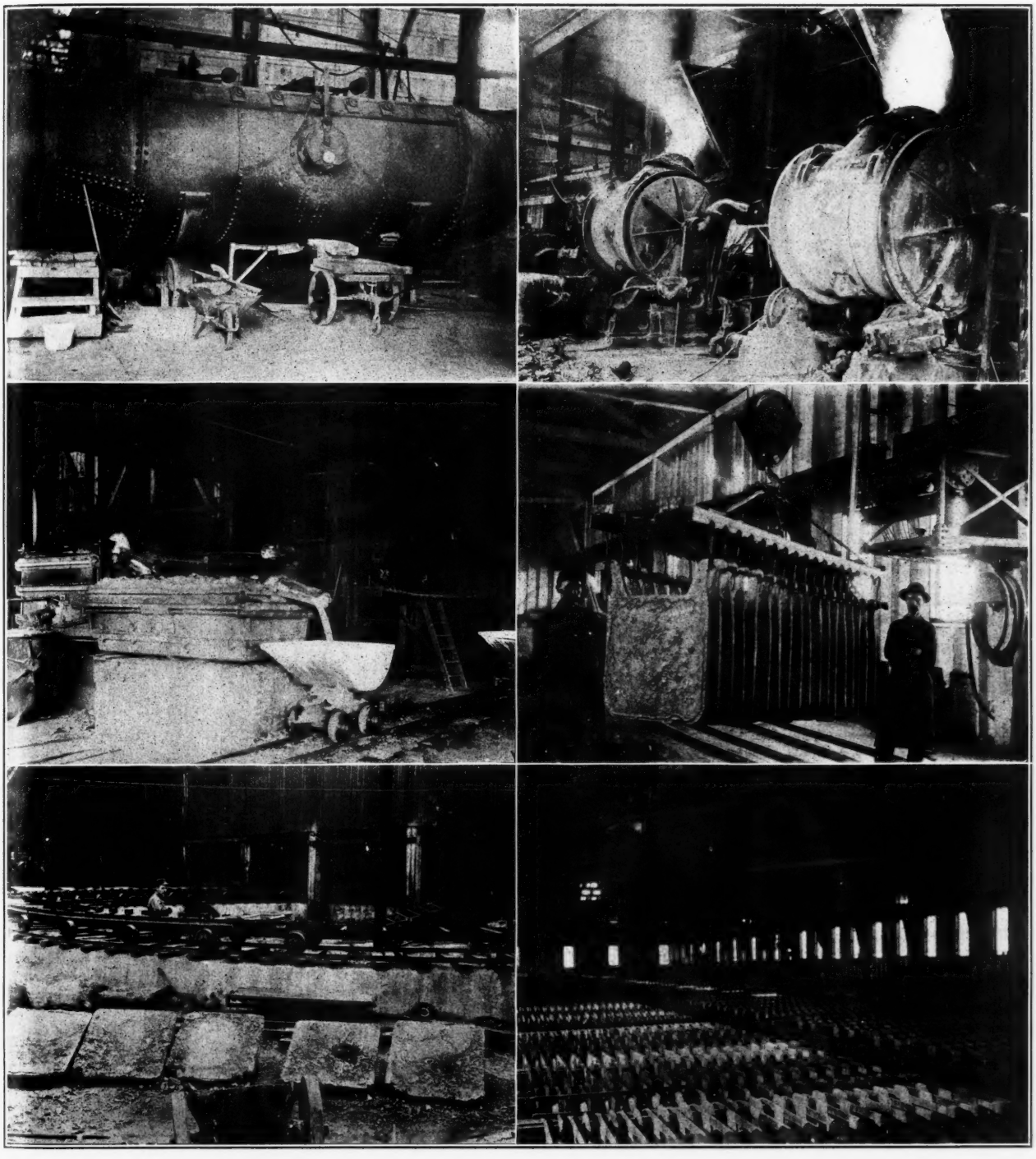
The concentrate furnace in the copper plant is of the Allis-Chalmers type, and has a maximum capacity of about 350 tons every twenty-four hours. The furnace is divided into two sections, one elevated slightly above the other for convenience in removing the slag, the latter being discharged into ladles mounted on trucks. The metal itself is poured into another ladle, which is taken to the converting department. Here it is run through cupolas, thence poured into tilting converters, where it is subjected to an air-blast. The process is similar to the manufacture of Bessemer steel, and the product remaining, though crude copper, contains a very high percentage of pure copper.



Transmission System Conveying Current from Mount Ranier, Fifty Miles Distant, Tacoma Smelting and Refining Company.

Nowhere, however, has the electric current been utilized in a more remarkable way than in the separation of copper from the precious metals by the electrolytic process here used. To study the action of the current in transferring the metal from anode to cathode is indeed fascinating. The length of time usually required to reduce the anode to merely a fragment of metal so thin that it can not sustain its own weight, is between twenty and twenty-four days. During this period the action of the current has literally built up the corresponding cathode, so that from a sheet of copper but a twenty-fifth of an inch in thickness and weighing a few pounds, it may be over an inch in thickness, weighing 250 to 300 pounds.

The tanks utilized for this purpose are constructed of wood coated with metal to prevent them from being affected by the electrolyte. In the Tacoma plant they are about three feet in depth. The electrolyte is merely a solution containing about sixteen per cent of bluestone and about five per cent of free sulphuric acid. The bath is tested daily as it is necessary to



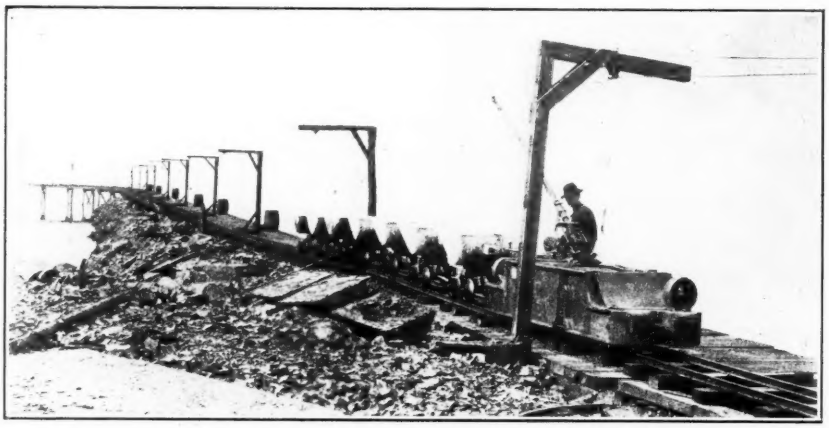
THE TACOMA SMELTING AND REFINING COMPANY. 1.—ROTARY SMELTER OPERATED BY MOTORS. 2.—MOTOR-OPERATED REVERBERATORY FURNACES. 3.—POURING SLAG FROM ROASTER. 4.—ELECTRIC CRANE SERVING ELECTROLYTIC DEPARTMENT. 5.—MOTOR-OPERATED CIRCULAR SLAG-CASTING MACHINE. 6.—GOLD AND SILVER BEING SEPARATED FROM THE COPPER BY ELECTROLYSIS.

maintain the proportions as exactly as possible. Each cathode is of course set in the tank next to the anode from which it secures its supply of copper, each set of anodes constituting an electric circuit. The necessary connections are made between the various tanks by copper circuits. In operation the current enters a tank through the anodes, then passes through the solution to the cathodes, the space between anode and cathode being a little over one inch. From the cathodes the current passes to the anodes, which are insulated from the negative conductor of the adjoining tank. It then goes through the bath and the cathodes of this tank, and so on to the third tank, where the process is repeated, transferring the metal as in the electro-plating process.

The gold and silver which may be held in the anode are precipitated to the bottom of the tank in a black slime. In securing these metals the slime is first run through a screen, then placed in a vat lined with lead containing a solution of twenty-five per cent sulphuric acid and seventy-five per cent water. Into the bath hot air and steam are injected. Application of this treatment for eight or nine hours dissolves the impurities in the composition, and they are removed with the solution from the slime, usually by syphoning. The latter is then dried on iron pans in a hot-air chamber, and the gold and silver separated from it in the lead refinery.

For the electrolytic department a current varying from ten to fifteen amperes to the square foot is employed, the volume of current depending upon the proportion of silver and gold in the alloy, as well as the percentage which may remain of impurities. Should the latter be high, too much current density would force some of the silver as well as arsenic which may remain into the cathode, thus affecting the quality of the copper. In current distribution less than half a volt is required on the average to each tank. The current is carried to this department by means of ten cables, the current being transformed from 40,000 volts to 100 volts. All of the electricity is secured from the generating plant in the foothills of Mount Ranier, and brought by long-distance transmission line a distance of nearly forty miles.

The copper reduction department was constructed under the supervision of B. H. Bennetts. Some of the apparatus was designed by Mr. Bennetts especially for these works. One noteworthy feature is a circular slag-casting machine intended to do away with much of the ordinary labor required to break up and remove the slag.



Trolley System and Electric Locomotive for Hauling Slag, Tacoma Smelting and Refining Company.

The machine is provided with 144 tilting molds and has a total capacity of twenty tons. It is situated at the side of the building where the furnaces are installed, and is served by a twenty-ton electric traveling crane, which removes the ladles as fast as filled by the slag spout and empties them in the molds, thus doing away with the necessity of hauling the slag from the furnace by tram-cars.

At the Tacoma works a reverberatory furnace is employed for the reduction of concentrates. These are received from British Columbia, Alaska, California, Oregon, Mexico, and Central and South America. The matte averages from forty-five to fifty-five per cent copper. The slag is tapped into ladles, by which it is carried to the casting machine, which is revolved by a twenty-horse-power variable-speed motor. The molten matte is also tapped into ladles, by which it is carried directly to the two converters. The matte is blown by 3,500 cubic feet of air per minute to each converter. The furnace for casting the anodes is of the rotary type, heated by fuel oil. It is also served by an electric traveling crane from the converter. After the metal has been melted, it is cast into anodes averaging 125 pounds in weight. In the electrolytic department the cathodes are removed from the vats by an electric traveling crane of twenty tons capacity, loaded on cars and returned to the furnace department, where they are melted and cast into ingots, cakes, etc. The average daily output of the works is thirty to forty-three tons of pure copper besides the precious metals.

The Tacoma plant secures its electric current by long-distance transmission from a generating station at Electron, Washington. About 2,000 horse-power is utilized in the various departments. Besides the use of electric current in the electrolytic department, the tramway about the works is served by motors. Incidentally, it may be remarked that in connection with this plant has been erected one of the highest chimneys yet constructed of reinforced concrete. As the works are partly surrounded by high hills, to carry away the fumes it was necessary to erect a stack 306 feet in height. This is situated 1,000 feet from the furnace.

Steam Motor-Car's First Run.

After a successful trip of 813 miles, from Dayton, Ohio, to Jersey City, running under its own power, the first steam motor-car of the Ganz type ever run in the United States reached the Erie Railroad station in Jersey City last Tuesday morning.

Save for a slightly conical front, in which section the machinery is located, the car is similar to all Erie suburban passenger coaches of the new standard type. At the front of the car is a small compartment six feet long which contains a 120-horse-power Ganz steam generator forty-two inches in diameter and five feet high. This compartment also contains the control levers.

The car is propelled by two steam motors of sixty horse-power each, equipped with air-brakes, lighted by acetylene gas, heated by steam, and weighs forty-five tons in complete working order and with fuel and water sufficient for a continuous run of fifty miles. The fuel is carried in a small bunker built on the outside at the front end. The water tank, capacity 600 gallons, is built into the underframe.

The car is designed to make a speed of forty miles an hour on a level track and fifteen miles an hour on a two per cent grade. It will also haul a trailer at a speed of thirty miles an hour on a level track and at eleven miles an hour on a two per cent grade.

BALANCERS VERSUS THREE-WIRE DYNAMOS.[1]

BY BUDD FRANKENFIELD.

Despite all efforts to produce an incandescent lamp of a voltage sufficient to render the operation of two lamps in series unnecessary from the standpoint of economy in copper, the three-wire system is to-day in general service. The recent introduction of metallic-filament of high efficiency, lamps which seem to be inherently low in voltage, points if anything to a longer lease of life for the three-wire system.

Like many of the Edison inventions, the three-wire system is a perfect solution of this problem. In all its years of usefulness it has been subject to improvement only in the nature of engineering refinement; namely, its adaptation to the needs of colossal undertakings, its submission to the untiring spur of economy. This latter phase is the one with which the present paper has particularly to deal. Any effort to reduce the cost of installation or of operation must meet in addition all the rigid requirements of regulation and of schematic simplicity so beautifully met by the Edison three-wire system.

The Edison unit, consisting of two dynamos connected in series, with the neutral wire tapped in at the common point of connection, is of itself a suggestion for a more economical arrangement. Obviously this unit occupies more floor-space than a single dynamo of equal capacity, requires more attention, and in small sizes is less efficient.

Inventors sought for a long time to devise a three-wire dynamo to replace the two machines of the Edison unit. They have succeeded, but within limitations. A few types that have been placed on the market will now be described.

One of the oldest machines, Fig. 1, accredited to Hopkinson, consists of a machine having two equal windings and two commutators. The two windings are connected in series and to the neutral, after the manner of the two machines of an Edison unit. In regulation, this machine has the advantage that any reduction in voltage due to armature reaction affects both windings alike, the only difference between the two delivered voltages being the excess of resistance drop in the heavier loaded winding on unbalanced load. The armature must be made longer on account of the two commutators, and the shaft somewhat heavier than in the case of a two-wire machine. This makes the saving in floor-space and in first cost less than one's ideal of a three-wire dynamo leads him to expect. Furthermore, it is impossible to regulate the voltages independently except by shifting the brushes—hardly a practical method.

The three-wire dynamo of Dobrowolsky is shown in Fig. 2. A choke-coil is tapped into the armature winding at the two points of opposite potential (assuming bipolar construction), and the centre of this coil is connected to the neutral wire. If the choke-coil is mounted so as to rotate with the armature, the neutral is connected to the centre of this coil by means of one slip-ring; if mounted in a stationary position, as shown in the diagram, the outside terminals of the coil are connected to the armature through the medium of the two slip-rings and the neutral connection is tapped in solid. The centre of the choke-coil is at mid-potential, and any difference in current between the two branches of the system can flow along the neutral and through the coil, which offers no impedance to direct current. The windings of the choke-coil are arranged so that the direct currents in the coil are magnetically opposed, thus avoiding saturation of the core. This feature is only partially accomplished. An alternating magnetizing current and also an alternating core-loss current are present in the coils, and both these currents increase with unbalanced load because it is not possible to completely eliminate unidirectional magnetization.

Lamme's modification of this invention, Fig. 3, consists in making the slip-ring connection two-phase; there are four slip-rings besides the commutator, and two choke-coils connected in star. The neutral wire is connected to the centre of this star. By this means a slight gain is made in the distance the neutral current must traverse the armature winding.

Both machines, while simple in principle, are sufficiently complicated in the connections to render the locating of trouble an irksome task. In addition, the increased length of shaft required for the slip-rings cuts down the saving in floor-space, and it is impossible, without added complication and mechanism, to regulate the voltages independently. An admission of this weakness is evidenced by the fact that two large manufacturers have taken out patents on an additional auxiliary device, practically amounting to a balancer, the purpose of which is to regulate the two voltages.

The three-wire dynamo of Osana, Fig. 4, is provided with an auxiliary winding laid in the same slots as the main winding, usually in the bottom of the slots. Sections of this auxiliary winding are proportioned to develop opposed voltages of half the value of the main voltage. It is tapped into the main winding at the opposed points of connection, and the centre of each section is connected to a slip-ring which is in turn connected by a brush to the neutral. If the conductors of Dobrowolsky's choke-coil were placed in slots on the armature surface and connected so as to develop an electromotive force equal and opposite at every instant to that impressed on the terminals of the coil by the main winding of the armature, there would be no alternating current in the coil and the magnetizing and core loss components would not exist. This, in fact, is the embodiment of Osana's machine. It is said that there is no gain without some sacrifice, and the sacrifice in this case lies in placing the auxiliary winding in the armature slots, the most valuable space in a dynamo. On account of the heating of the auxiliary conductors and the increased slot depth required, it is necessary to make the armature of a machine of this type of increased diameter. The old weakness, lack of independent voltage regulation, is common to this machine also. One attempt has been made to overcome the difficulty by mounting the positive and the negative brushes on independent rockers, and supplying means for shifting these brushes independently. Imagine the confusion in a station using this system when it becomes necessary to balance the voltages. In a small station the attendent would be kept running back and forth from the switchboard to the dynamo, reading the voltmeter and adjusting the brushes. In a large station, with a switchboard attendant located in a gallery, the amount of signaling to the dynamo man would be prohibitive. Again, in order to regulate the voltages in this manner the machine must be designed with an unusual margin in commutation.

An interesting machine is that of Dettmar and Rothert, Fig. 5. Here a two-pole armature is mounted in a field having four salient poles. Poles of like polarity are situated in juxtaposition, each pair forming a single pole. In reality, the machine is a two-pole dynamo with a wide gap in the centre of each pole. The neutral brush is placed opposite this gap. Armature reaction, even with balanced load, weakens the upper south pole and strengthens the lower south pole; likewise

[1] Paper read before the National Electric Light Association at the Thirtieth Convention, Washington, D. C., June 6, 1907.

the lower north is weakened and the upper north is strengthened. The result is that the voltage on the positive side of the system becomes lowered and that on the negative side increased. This is overcome by compounding the weakened poles cumulatively and the strengthened poles differentially. The same winding is effective in balancing the voltage automatically. It is also possible, by connecting the shunt field coils in two independent circuits, to regulate the voltage independently by hand. This machine accomplishes in regulation all that can be done with an Edison unit. The chief disadvantage is its excessive weight, the yoke and armature core being twice the cross-section of an ordinary four-pole machine. If made with more than four poles, the construction is limited to an even number of pairs of poles.

An objection to all three-wire dynamos is that, in order to compound them so as to deliver the necessary total voltage at any load, the series field-winding must be divided into two circuits, half the total number of coils being connected in series with each main. The connections for the Dettmar and Rothert machines have just been described. In the other machines the series coils are all made cumulative, and coils that are mounted on poles of like polarity are connected in series with one leg and those of the opposite polarity in series with the other leg. To connect from coil to coil in either circuit requires a jumper spanning a complete pole. As stated, this compounds for the total voltage only and has no effect whatever in balancing the voltages.

To operate two compound three-wire dynamos in parallel two equalizer bars are necessary, one for each series field-circuit. This adds an additional and expensive feature to the switchboard, and in switchboards of large central stations there would be difficulty in finding room for the extra equalizer. A diagram for multiple operation is shown in Fig. 6. There are six heavy cables of full-load capacity running to the switchboard, and, in addition, there is a neutral cable. In the case of the choke-coil system the coils are often placed back of the switchboard or at some equally distant place from the machine, requiring in this case four small cables leading from the machine. All of these wires are multiplied for every three-wire machine in the plant; the item of expense is considerable, and should not be neglected when comparing different three-wire systems. One might think that four full-current cables would suffice, two for the equalizers and two for the leads. The figure shows that two additional cables leading from the armature are necessary in order to obtain adequate protection for the machine. These two cables lead to the ammeter shunts and the two circuit-breaker coils. An attempt has been made to avoid the use of these two cables by mounting the ammeter shunts on the terminal blocks of the machine and running long lead wires from these shunts to specially calibrated ammeters on the switchboard. In this case the circuit-breakers are placed in series with the cables leading from the series fields. This is not the place for a protective device, because it is liable to throw the machine out of service when the armature is not at all overloaded; since the coil of the circuit-breaker might be actuated by the sum of the armature current plus an equalizer current from the other machines just at the time when equalization is most needed. In order to get equalization comparable to that of two-wire dynamos, it is imperative to use the six big leads to each machine.

In order to operate a compound two-wire dynamo, in parallel with compound three-wire dynamos, it is necessary to split its series field into two circuits and supply two equalizers. Standard two-wire dynamos must therefore be remodeled to the extent of a reconnection of the series fields and the addition of at least one new terminal block for the extra equalizer. Many machines are so built that it is difficult to make these changes without considerable expense; for example, a machine with rectangular poles having the series-coil leads coming out between the poles may require rewinding of the series fields.

The little that is gained over the old Edison system by combining two-wire and three-wire dynamos in one plant is more than lost in the inability to regulate the pressures.

Another difficulty common to all machines with double equalizers is that, unless the machines are fully built up before the equalizers are thrown in, a short-circuit of the most violent nature is likely to occur through the armature of the incoming machine. This is because the equalizers are at the full terminal difference of potential.

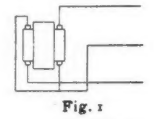


Fig. 1

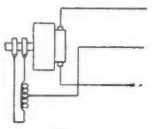


Fig. 2

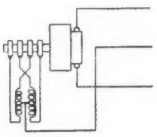


Fig. 3

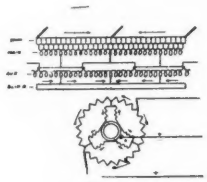


Fig. 4

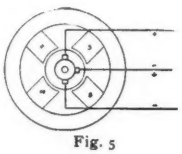


Fig. 5

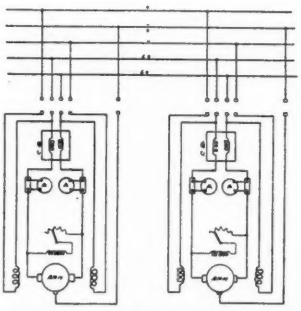


Fig. 6

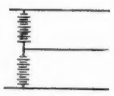


Fig. 7

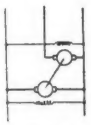


Fig. 8

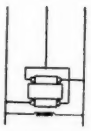


Fig. 9

1—Hopkinson Three-Wire Dynamo
2—Three-Wire Dynamo of Dobrowolsky
3—Lamme's Modification
4—Three-Wire Dynamo of Osana
5—Dettmar and Rothert Dynamo
6—Diagram for Multiple Operation
7—Electrochemical Form of Balancer
8—Early Type of Balancer
9—Diagram of Balancer Connections

BALANCERS.

The balancer system was devised as a means for supplying a three-wire system from a station using standard two-wire dynamos as the generating units. It is claimed that a station designed on this plan has the advantage in cost and simplicity over a station using three-wire dynamos.

Fig. 7 illustrates the electrochemical form of balancer. The storage battery not only takes care of the peaks of the load but may also be used to regulate the voltages. On unbalanced load one side of the battery may be charging and the other discharging, and the voltage may be regulated by shifting the point of connection to the neutral, or preferably by a

system of end-cell switches or boosters. The diagram of connections of an actual installation is not so simple as the one shown, owing to the use of boosters and end cells. The battery is too bulky to be used as a balancer alone, its chief function being to take care of the peaks. Like all balancers, the storage battery may be located at a distance from the station, thereby saving in feeder copper.

The dynamoelectric form of balancer may be divided into three classes:

1. Balancers that give baianced voltages only on balanced load. These have the weakness common to three-wire dynamos.

2. Balancers that may be regulated manually to balance the voltages. This class is suitable for central station duty where the plant is large enough to require a switchboard attendant. A system of this kind is comparable with the Edison system.

3. Balancers that regulate inherently for balanced voltages under any condition of load. These should be used where there is no attendant and where the unbalanced load fluctuates rapidly over a considerable range.

BALANCER SWITCHBOARDS.

Balancer switchboard diagrams vary considerably with the particular balancer system employed. They may be simple or complicated, depending on the ability of the designer; but in any case the switchboard connections required to take care of a three-wire load are not multiplied for every dynamo in the station. They are confined to one panel for each balancer set, and the cables and other switchboard paraphernalia are limited to a capacity represented by the unbalanced load or a share thereof. Several balancers may be operated in parallel when conditions require it.

The chief objects to be kept in view in designing a switchboard panel for a balancer are (1) simplicity of operation; (2) protection of lights; (3) protection of balancers.

It is possible to arrange the connections so that a balancer may be started up or paralleled by just three operations: (1) closing of a main switch; (2) operating the starting lever; (3) closing the neutral or neutral and equalizing switch.

As to protection of lights, a balancer should not be connected so as to be cut out of service due to overload, without also cutting out the lights; otherwise, the lamps may be burned out or strained, or at least bad regulation will result. A balancer should be built for hard service and should not be cut out for trifling causes. It can be built to stand the rigors of heavy central-station duty, the taking of overloads with good regulation, the burning off of grounds. For this reason protection of balancer is placed as the least important. Keep the lights burning at all hazards and build the balancer to stand the strain.

RATING OF BALANCERS.

The logical method of rating balancers is on the basis of neutral current, that is, a fifty-kilowatt balancer operating on a 120 to 240-volt circuit would supply a neutral current of 147 amperes.

SIZE OF BALANCER.

The capacity of a balancer should be based on a certain definite allowable percentage of unbalancing. The value of this percentage depends entirely on the patience and skill exercised in making and studying the service connections. In average practice the capacity in kilowatts of a balancer will vary from ten per cent of the total load in a well-balanced installation to twenty per cent in poorly balanced ones. Where there is a totalizing circuit-breaker connected in the outside wires, the nominal rating of the balancer need not exceed the anticipated amount of unbalancing, but it should have a good momentary overload capacity. Where there is no totalizing circuit-breaker the balancer should have a momentary overload capacity of twenty-five per cent more than the largest outside feeder fuse, and in heavy central station work it should be capable of burning off grounds. Owing to the multiplicity of feeders, this does not make the capacity excessive.

TYPES OF BALANCERS.

An early type of balancer, shown in Fig. 8, consisted of a motor-generator with one armature connected across the mains, and the other between one main and the neutral. The fields were often connected independently across the mains. In this machine the entire amount of power represented by the neutral current must undergo or be the result of a transformation. In the balancers shown in Figs. 9, 10, 11 and 12, only a little less than half the neutral current represents transformed power, and the unit need be only about half the size of a balancer connected as in Fig. 8.

OPERATION OF A BALANCER.

Omitting Fig. 8 from further consideration, let us consider the action of a balancer in service.

Fig. 13 represents the current distribution in a balancer system. At no load, balanced load on the system, there is a loss current I_l in the two armatures of sufficient magnitude to supply the stray power of the two machines. As the load becomes unbalanced, say in favor of the upper side of the system, the drop between the upper wires and the neutral, due to the low resistance of the load on that side, approaches more nearly to the counter-pressure of the machine G and the loss current becomes unequally divided, decreasing in G and increasing in M by an equal amount. The excess of this loss current in M is supplied by the establishment of a current I_m in the neutral. A still further unbalancing decreases the loss current in G and increases it in M by an equal amount until a point is reached where the loss current in G is zero and machine M carries the entire loss current of the two machines. At this point G is acting as a generator operating on no load and M as a motor under a load equal to the stray power of G, and the current I_m is equal to $2I_l$ of the no-load condition. A further unbalancing establishes a current I_g, a generator current emanating from G, and increases the current I_m enough to supply I_g and its attendant losses.

Fig. 14 represents this sequence graphically. Motor currents are plotted to the left and generator currents to the right of the zero line. The vertical scale represents watts output of the motor and watts intake of the generator, and the horizontal distance between the two curves is the neutral current, I_n. At balanced load the distance Oa represents the current I_l, a motor current equal in each machine. As the load becomes unbalanced, the motor current of one machine decreases and that of the other increases an equal amount. Finally, at a transmitted wattage between the two machines equal to Ob, the armature current of one machine is zero and that of the other $2I_l$, equal to I_m, which is also the neutral current. A greater unbalancing establishes a generator current I_g as shown. Below the point b the neutral current represents the difference between the two motor currents, above b it is the sum of motor current I_m and a generator current I_g. The generator action on the one side arrests the drop in pressure between the corresponding main and the neutral, and the motor action on the other side has a like effect.

REGULATION.

The inherent regulation of a shunt-wound balancer depends upon its field connection. In Figs. 9 and 10 the amount of shifting of the neutral potential from balanced condition is equal to half the

neutral current multiplied by the resistance of one armature circuit. In Fig. 11 there is a variation of field flux with load, and the regulation is not so good. In Fig. 12, where the fields are crossed, the regulation is better than in Figs. 9 and 10, and is even better than that of a two-wire dynamo. The exact method of determining this regulation has been worked out, but it is of interest chiefly to the designer, and is omitted in the present paper.

Shunt balancers may be regulated manually, by field rheostats, the same as the Edison unit. The inherent regulation can be made better than that of an Edison unit, and the shunt-wound balancer is recommended wherever there is a switchboard attendant, and for all cases where the changes in load are slow.

COMPOUNDING.

Where the load fluctuates rapidly and where there is no attendant, the balancer should be compounded. This is generally done by compounding the motor differentially and the generator cumulatively. The amount of compounding per machine is only about half of an ordinary lighting dynamo of the same size, and the bugbear of the differential motor disappears, even with large overloads. In fact, it is possible to build a compound balancer so that its speed will be constant up to the burning-out point.

It is interesting to consider the amount of overcompounding to give respective to the generator and the balancer in order to deliver constant balanced voltages at a centre of distribution when the mains and neutral have an appreciable drop. This is a problem often met. A service that demands a limiting variation in voltage of but two per cent at the lamps must be supplied with balanced voltages at the centres of distribution.

Fig. 15 shows how the drop is distributed. It will be noticed that the drop in the neutral reduces the pressure on the heavily-loaded side and increases the pressure on the lightly loaded side.

Let the pressure delivered at the centre of distribution be E on each side of the system. Let the other symbols be those shown in the diagram. Then, the terminal pressure of the generator must be

$$2\,E + I_1R + I_2R_1$$

and the generator must be compounded to increase its volts

$$I_1R + I_2R.$$

Lamp pressure on (+) side

$$= E + \frac{I_1R}{2} + \frac{I_2R}{2} - I_1R -$$

$$(I_1 - I_2)\,R_n = E - (I_1 - I_2)\left(\frac{R}{2} + R_n\right);$$

Pressure on (—) side

$$= E + \frac{I_1R}{2} + \frac{I_2R}{2} - I_2R +$$

$$(I_1 - I_2)\,R_n = E + (I_1 - I_2)\left(\frac{R}{2} + R_n\right);$$

i. e., $(I_1 - I_2)\left(\frac{R}{2} + R_n\right)$ must be added to the (+) side by the balancer and subtracted from the (—) side. This is the balancer compounding.

When $R_n = 2R$, the compounding of the balancer is

$$(I_1 - I_2)\,\frac{5\,R}{2} = \frac{5\,RI_n}{2} = 2.5\,I_nR.$$

To get the per cent of balancer compounding based on the generator compounding,

$$\frac{2.5\,(I_1 - I_2)\,R}{(I_1 + I_2)\,R} = \frac{2.5\,I_n}{I_1 + I_2}.$$

Example:

Assume five per cent generator compounding,

$I_1 = 3{,}300$ amperes, $I_n = 3{,}300 - 2{,}700 = 600$ amperes,

$I_2 = 2{,}700$ amperes, $I_1 + I_2 = 6{,}000$ amperes

Then $\frac{2.5 \times 600}{6{,}000} = 0.25$,

and balancer compounding $= 5 \times 0.25 = 1.25$ per cent, which shows that the compounding required of a balancer, even when there is an appreciable neutral drop, is very small.

Many central stations in this country have several engine-driven Edison units operating in parallel with two-wire machines of full-line voltage, the Edison units being used to balance the voltage. If these Edison units were disconnected from their engines and coupled up as balancers, the capacity of each unit with respect to neutral current would be doubled, nothing would be lost with respect to regulation and the engine could be dispensed with.

The economy is still greater when a new layout is considered. Fig. 16 illustrates a station which, for the sake of comparison, has been taken at 1,900 kilowatts, ten per cent of which is unbalanced load. It consists of a 900-kilowatt engine and generator and a 200-kilowatt engine and Edison unit. Fig. 17 represents a balancer system of the same capacity. The main engine and generator are in this case of 1,000 kilowatts. The Edison unit and its engine are dispensed with in this case and a balancer, consisting of two fifty-kilowatt machines, is used instead. While the electrical portion of the installation aggregates the same in each case, the balancer can be operated at a higher speed than the Edison unit and there is a saving in first cost of engines, foundations, and floor space.

Continental practice favors the balancer system. While it has also been used freely in this country, we have of late experienced a fad in three-wire dynamos which the dictates of good engineering will not permit to endure.

In conclusion, a comparison of the three-wire dynamo with the two-wire dynamo and balancer may be summarized as follows:

1. The three-wire dynamo can not be regulated for equal voltages; the balancer can.

2. The balancer can also be made to regulate inherently for equal voltages; the three-wire dynamo can not.

3. The balancer is capable of carrying a neutral overload with good regulation; the three-wire dynamo can carry it, but only with poor regulation.

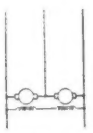


Fig. 10

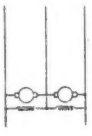


Fig. 11

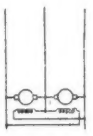


Fig. 12

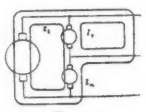


Fig. 13

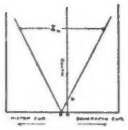


Fig. 14

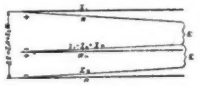


Fig. 15

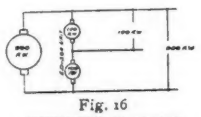


Fig. 16

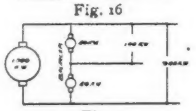


Fig. 17

10—Diagram of Balancer Connections
11—Diagram of Balancer Connections
12—Diagram of Balancer Connections
13 Current Distribution in a Balancer System
14—Current Distribution in a Balancer System
15—Diagram Showing Distribution of Drop in Voltage
16—Three-Wire Station Balanced by Small Edison Unit
17—Equivalent Station with Balancer

4. The three-wire dynamo represents extreme specialization in design. This means long delivery when in a hurry to increase the size of a plant. It means delay when it becomes necessary to make repairs. The two-wire plant with a balancer consists of standard apparatus throughout. This means quick delivery and quick repairs.

5. The three-wire dynamo has complicated connections repeated for each unit in the plant; this makes it difficult to locate trouble. The connections of a two-wire plant using a balancer are simple and easy to understand. Trouble is easily located.

6. The three-wire dynamo requires expensive switchboard connections and a lot of heavy cables. The two-wire plant with balancer does not.

7. A two-wire dynamo will not operate successfully in parallel with a three-wire dynamo without remodeling. Any number of two-wire dynamos can be added to a two-wire plant with balancer without making a single change in their construction.

8. There is danger of a violent short-circuit when a three-wire dynamo is brought up to speed and paralleled. This danger does not exist in equalizing a two-wire dynamo or in equalizing a balancer.

9. A three-wire dynamo requires two double-pole circuit-breakers. The two-wire dynamo requires but one. The balancer requires but one.

10. The three-wire dynamo plant requires two equalizers. The two-wire plant requires one, and when compound balancers are operated in multiple the equalizer outlay for this portion of the plant is insignificant.

11. The three-wire dynamo plant requires two ammeters for each machine. The two-wire plant with balancer requires but one ammeter for each machine and one for the balancer.

12. The balancer can be located at a distance from the station. The three-wire dynamo must reach out from the station to the distant point.

13. Lastly, it should be emphasized that the balancer is not limited to isolated-plant service, but is capable of much heavier duty.

The Canadian Street Railway Association.

A meeting of the Canadian Street Railway Association was held at Windsor, Ontario, on June 14 and 15. This meeting was particularly successful and was attended by a delegation from the Detroit (Mich.) United Railway Company, which, later, acted as host to the Canadian Street Railway Association, which made an inspection of the company's construction yards, power-houses and offices.

The next meeting of the association will be held in Montreal, in September, in conjunction with the Canadian Electrical Exhibition, which will be held September 2-14.

Among the papers read were the following: "Electric Railroad Development in Eastern Canada," by Patrick Dubee, secretary Montreal Street Railway Company.

"Electric Railway Development in Montreal," by R. J. Clark, assistant to the controller, Toronto Railway.

"Standardization of Electric Railway Equipment," by C. B. King, manager London, Ontario, Street Railway.

In his paper Mr. Dubee gives some interesting history of Canadian electric railway development.

The first city in Eastern Canada to adopt the electric system was Ottawa, the first car being in operation on June 24, 1891. In the fall of the following year, electric cars were in operation in Montreal; in September, 1892, in St. John, N. B.; in 1896 in Halifax, and in 1897 in Quebec; and since then in Cornwall, Levis, Sherbrooke, Yarmouth, etc.

The progress of the electric system in eastern Canada, when the difficulties and the large expense to be met in operating in the winter months is considered, has been very satisfactory, as can be seen by the following statement.

	1892.	1906.
Miles of single track...	92	351
Passengers carried....	28,392,450	103,232,140
Gross earnings.....	$860,000	$5,578,494
Capital invested	$4,000,000	$22,782,133

In considering these figures, it is important to bear in mind, that there are practically no suburban lines in eastern Canada, and that there are only four cities of a population of over the 50,000 mark, and twelve cities in which electric cars are in service.

It will be of interest to know that the average cost of operation in winter for the last ten years on the Montreal Street Railway system has been about seventy per cent against about fifty-two per cent during the summer for the same period.

The present rail is eighty-seven pounds per yard, T-section, and laid in paved streets with tie rods and steel ties, the groove for the flange of the wheels being cut out of the blocks, making less noise in operation than the grooved rail, and a better surface. The rail is well surfaced with concrete stringers. The eighty-seven pound T-rail in macadam is laid on well-spaced wooden ties, and with the tie rods every six feet, and well surfaced and packed with good clean macadam. On hills and in some locations ninety-six pound girder rail is used, but T-rail is used wherever practicable. Intersection work is now made of the best manganese steel, and switches, crosses, diamonds are now all of one piece, instead of built-up work, or insert pieces as formerly.

One of the most important developments in the car equipments has been in the method of braking. All modern cars weighing over 30,000 pounds are equipped with power brakes, operated by air or other means. The severe braking requirements of modern practice, when cars are operated at a high rate of speed, can easily be attested, and the wonderful success attained by these brakes is too well known to be further commented on.

Mr. Clark in the opening portion of his paper discusses general statistics of electric railways in the Dominion. In 1895 there were twenty-one electric railway companies with a capital of $13,035,263, operating 354½ miles of track, carrying 55,348,612 passengers. In 1898, there were thirty-five companies with a capital of $28,763,328, operating 635 miles of track, carrying 94,616,344 passengers. In 1901, there were forty-three companies with a capital of $38,637,497, operating 672 miles of track, with gross earnings of $5,422,539. In 1905, there were forty-six companies with a capital of over $50,000,000, operating 793 miles of track with gross earnings of $9,357,126, and net earnings of $3,438,931.

Electric Elevators in South Africa.

The South African demand for electric elevators is stated to be rapidly increasing. The erection of many high buildings, says a recent consular report, creates a demand for construction material, and on account of the scarcity of water for the hydraulic elevator those new buildings are largely demanding the electric lifts. Not only are the commercial emporiums putting in these electric elevators, but the hotels as well. As there is a decided tendency to erect more up-to-date hotels, the call for such appliances should be much extended.

American Institute of Electrical Engineers—II.

Twenty-Fourth Annual Convention, Niagara Falls, N. Y., June 25 to 28, 1907—Thursday's and Friday's Sessions.

THURSDAY MORNING SESSION.

THE Thursday morning session was opened by the presentation of a paper by E. G. Acheson, entitled "Deflocculated Graphite." Mr. Acheson described a new lubricant to which reference had been made previously, and showed certain of its peculiarities by experiments. He said that the subject is developing so rapidly that it is impossible in a written paper to keep up with it. One of the experiments shown was that by the addition of a little tannic acid in the form of galotannic acid to a mixture of this graphite in water, a drop of ammonia being added to neutralize the effect of the water, distilled water not being available, the graphite remained in suspension. A similar quantity of the same graphite was also mixed with water, no acid being added. The graphite of this mixture settled rapidly. Upon pouring the two mixtures into filter paper, the former ran through, while from the latter all the graphite was filtered out. The filtrate of the tannic acid mixture was then taken, and the ammonia neutralized by a drop of hydrochloric acid. Upon heating, the graphite separated from the water, and was easily filtered out. Results were then given of tests made by Professor C. H. Benjamin, of the Case School of Applied Science, Cleveland, Ohio, which showed that the introduction of one-half per cent of this graphite to a certain sample of oil reduced the coefficient of friction to sixty-five per cent of the oil alone. After running for sixty minutes the coefficient of friction was fifty-five per cent of that of the oil alone. During this time the friction of the oil had increased fifty-four per cent, and that of the graphite only thirty per cent. Similar effects were produced to a more marked degree by increasing the percentage of the deflocculated graphite. After running for some time, the lubricant was shut off, and in thirty minutes the coefficient of friction of the oil had increased 125 per cent. That of the oil and graphite increased only fourteen per cent in eighty minutes. Samples of graphite prepared with the proper amount of tannic acid were shown, which were intended to be introduced into a given quantity of oil in order to give it the improved character.

In discussing the paper, W. L. R. Emmet said that a serious problem for mechanical engineers to-day is the design and lubrication of high-speed and high-pressure bearings, and the effectiveness of the new lubricant in such bearings would be watched with interest. He asked whether any such tests had been made.

Carroll Thomas asked whether the graphite deposited upon the graphite bearing and thereby reduced its diameter.

Replying to these questions, Mr. Acheson said no tests had been made of high-speed or high-pressure bearings. The point brought up by Mr. Thomas had been thought of, but, upon investigation, no measurable deposition of graphite upon the babbitt had been found. He said also that the oil flowing away from the bearing contains the same concentration of graphite as the supply, showing that there is no filtering out in the bearing.

Two papers were then presented by A. H. Armstrong, the first entitled "Single-Phase *versus* Three-Phase Generation for Single-Phase Railways." This discusses the effects of the single-phase load on a three-phase generator, and methods which may be employed in order to minimize the unbalancing action. Considered merely from an engineering standpoint, the single-phase system of generation and distribution is to be recommended, and if a frequency lower than twenty-five cycles should be adopted, there would be less reason for adopting three-phase generation, as there would be no use of this low-frequency power for general distribution work. The single-phase system has a disadvantage, however, in preventing the sale of power and the use of synchronous converters. Where polyphase generation is employed, this may be distributed by means of motor-generator sets feeding into the single-phase secondary distribution by feeding the alternating current from one leg only, or by feeding successive sections of the railway from the different phases. Where two-phase generation is used, the separate phases may be employed for feeding different sections of the line, or three-phase generation may be employed, making use of three-phase-two-phase transformation for feeding. Of the several methods proposed, the motor-generator set best protects the three-phase distribution system, and has many advantages which may outweigh its increased first cost. Where the railway company finds it expedient to generate and distribute its own power from three-phase generators, the use of a single leg for the railway load or the installation of three-phase-two-phase transformer stations seem to offer advantages justifying their recommendation, so that the choice between the two may be left to the needs of the local requirements.

P. M. Lincoln opened the discussion by calling attention to a plan for regulating, or rather minimizing, the effect of the railway load on the general distribution system. This consists in giving an initial deformation to the three-phase delta of the generator equal to about one-half of that caused by the full railway load. This is in the opposite direction. The effect of the load upon this leg is first to correct the triangle and then to distort it again. However, the average distortion will be less than that were such initial unbalancing not given. Mr. Lincoln believes it is highly desirable to keep power in railway services separated if possible, but commercial considerations may render this not feasible.

V. Karapetoff thought that the distortion due to railway load might easily be corrected by placing an induction regulator in this phase of the generator.

J. B. Taylor said that correction was not so simple, and is more a matter of distortion of the triangle than of a lowering of the potential. He believes that in general the motor-generator solution will be the best for supplying the railway load, as this not only equalizes the load on all three phases, but removes the ground from one phase of the three-phase system.

William McClellan thought that the disturbance of the system was not so important when the railway company was generating its own power, but when it seeks to purchase power, this becomes a most important factor.

Dr. C. P. Steinmetz agreed with Mr. Taylor that the induction regulator would not restore the balance, because the single-phase power is pulsating, and not uniform, as is the three-phase output. The reaction on the generator is therefore pulsating. To maintain the triangle approximately in its normal form by intro-

ducing an initial distortion is open to the objection that the power-factor, and therefore the distortion, are not always the same. This disturbance is not of much consequence so far as the induction motors are concerned, but affects the synchronous converters. For this reason these should be installed in series with an inductance which will take care of the variation. The lighting load may be taken care of, because the disturbance due to the railway load on one phase leaves one of the other phases practically unaffected, and the lighting may be supplied from this. He said to use a distorted three-phase system was, in a sense, to resurrect his old monocyclic system.

In closing the discussion, Mr. Armstrong said that Mr. Lincoln's method would be permissible if the railway company were installing its own power-house. However, the problem of buying power is becoming more and more important, and under such conditions the motor-generator solution is almost necessary. In many cases there is but little to choose between the alternating-current and the direct-current systems, and in order to retain to the alternating system its advantages the generating station should hold all of those which go with the three-phase system.

Mr. Armstrong's second paper, which was then read, was entitled "The Choice of Frequency for Single-Phase, Alternating-Current Railway Motors." This considers the effect of frequency on the design of the motor equipment, on the coefficient of adhesion, on the generating and distributing systems, commercial considerations and locomotive design, and selection of motive power. The latter consideration is really the controlling one, and would lead to a decision in favor of a lower frequency than twenty-five—say, fifteen, if we were sure that the series single-phase motor, or those types of motor which have been discussed frequently of late, are the only ones offering a solution of the problem. There is a possibility, however, that other types of motor may be developed, for which a higher frequency may be more suitable, and with this in mind it would seem a mistake to decide now upon fifteen cycles as the standard. The higher frequency is better for all parts of the apparatus with the exception of the motor, and it is thought that this question might be left in abeyance until more experience has been gained in actual practice with the alternating-current motors.

N. W. Storer presented a paper entitled "Twenty-five *versus* Fifteen Cycles for Heavy Railways," in which he gives a good many data illustrating the relative performances and weights of motor equipments designed for fifteen and for twenty-five cycles. These all indicate that the lower-frequency motor has a considerable advantage. These motors may be rated at about thirty per cent greater output than motors of equal weight, but designed for the higher frequency. A locomotive equipped with them will weigh from ten to thirty-five per cent less than a twenty-five-cycle locomotive designed for the same output. There is no need to fix the frequency exactly at fifteen, but Mr. Storer thinks that the magnitude and importance of the electrification of steam railroads will be such as to warrant, and even compel, the adoption of a third standard frequency. Electrical engineers have an enormous responsibility in deciding upon these matters of detail. Any decision reached now will have an effect that will far outlast any who has a voice in the matter; therefore it is certainly of the greatest importance to consider carefully before recommending the continuance of the present standard frequency of twenty-five for railway work, where it imposes so great a handicap on the capacity of transportation systems.

E. J. Berg said that it is possible to obtain generating machinery for low frequency of equal output and efficiency as for a higher frequency, if an alternating current be employed for exciting the field.

L. B. Stillwell dwelt at some length upon the importance of the topic. The electrical engineer is now approaching the largest problem he has yet encountered, and he will find that in dealing with the steam railways, the conditions are not those which he met when introducing the electric lighting system or the trolley; that before he can approach this work with confidence, matters of detail must be fully decided upon. Mr. Stillwell referred to his recent Institute paper, and said that a very broad view of the problem must be taken; that since the total cost of electrification will not be less than $200 per kilowatt, a difference of $5 more or less in the cost of the generating equipment was insignificant. But the most important problem is the producing of locomotives large enough to handle a large and rapidly increasing traffic. Referring briefly to the 1,200-volt, direct-current system, this, he thinks, may have some advantages for interurban traffic, but for freight traffic not less than 6,000 volts on the trolley wire is essential. The railway company, in selecting equipment, will be seeking for draw-bar pull, and hence a fifteen-cycle locomotive, which has one-third the advantage over the other, will be adopted.

W. N. Smith thought the question too broad, and it yet too soon to tie the developing companies down to any particular frequency; but eventually the problem will simmer down to the creation of special supply systems for the railways, and the commercial side need not be considered.

William McClellan said that while the facts presented on both sides are in agreement, the opinions of engineers are different. He thought that the work should go on slowly. Ample power for transportation must be provided, probably from special power-houses; that the powers of transportation companies would probably be even more limited in the future than at present, and they will not be allowed to sell power. The question therefore comes down to the motor. He wanted to know what the consulting engineer should do under these conditions, and what he is to advise, particularly when hints are thrown out concerning a new motor which is said to be better than any which has yet been brought out.

Dr. Steinmetz thought there was some advantage in being able to get a supply from outside sources, so as to ensure against a breakdown. For this reason the higher frequency is advisable. Moreover, it would be disastrous to adopt a new frequency, and then find it unnecessary. So far as the present types of alternating-current motor are concerned, fifteen cycles is not the best frequency. The lower the frequency, the better; and passing to the limit, the direct-current motor is the best. Lowering the frequency, however, handicaps all the apparatus with the exception of this motor. For induction motors forty cycles is about the best frequency; hence for small motors sixty cycles is good, and, for larger ones, twenty-five. For transformers 125 seems to be about the best. For rotary converters, twenty-five is most suitable, and for another type of alternating-current commutator motor, twenty-five cycles seems also to be about the right frequency. Dr. Steinmetz said that it had been hoped that E. F. Alexanderson would be able to describe at this meeting a new type of motor which would seem to have better qualities than any which he had yet seen. Unfortunately, this had not been possible, but he promised that such a paper would be presented to the Institute shortly. In producing a satisfactory mo-

tor of the commutator type, one may either reduce the commutator losses by lowering the electromotive force between adjacent segments, or reduce the short-circuit current by increasing the resistance in the short-circuited coil, or eliminate the electromotive force which gives rise to these losses. It was on this principle that the new motor had been worked out.

C. F. Scott thinks that such questions as were under discussion were not to be answered by thus or no. A review of steam railway development would show that everything has centered about the locomotive—that is, about the draw-bar pull; hence this was the most important factor to be considered, and other elements should adapt themselves to it. He expressed surprise that the question of commutation should be brought up, saying Mr. Lamme has for some time considered that this problem has been definitely solved. The adoption of a new frequency was only desirable when good reasons exist, and if sufficient reason can be shown, then this should be adopted.

Peter Junkersfeld gave some figures relating to the situation in Chicago and the surrounding territory. He said that within twenty-five miles of that city the total power required to move the passenger trains would not be more than twenty to twenty-five per cent of the total power generated in the city. The general use of power is increasing more rapidly than the railways are developing, so that in five years this proportion will be only about ten per cent. Figures for the freight traffic were not obtainable. Taking into consideration the fact that for terminal electrification the direct-current system seems to be satisfactory, there is some question whether there would be sufficient justification for introducing a new frequency. In terminal work reliability is of primary importance. For this reason an odd frequency is not advisable. It should be possible for railways and the local power companies to exchange power, each thus insuring the other.

H. G. Stott thinks that it is impracticable for any railway to obtain power in an emergency from a local plant, saying that he did not believe there was any such plant which stood ready upon an emergency to supply twenty-five per cent of its total output. He thought the problem would be solved by the location of a number of independent plants along the railway, thus getting greater reliability, which is really more important than economy and cheapness. He thought, so far as reliability is concerned, the insurance is better if the coal be carried to the stations than if power be transmitted over a high-tension line.

In reply Mr. Armstrong said that the question lay between choosing that frequency most suitable for the motor and that best adapted to all the rest of the apparatus. He did not think there was as yet sufficient justification to adopt a lower and odd frequency. He agreed with Mr. Junkersfeld, that for terminal work direct-current systems are good, and so far as the alternating-current motor is concerned, we have not yet reached a final design.

In closing, Mr. Storer said that for the single-phase compensated series motor, fifteen cycles is about the best. The proposal is not due to a desire to change the frequency, but to increase the capacity of the locomotives, and hence of the railways themselves. He thought that since the railway companies represent such a small part of the total power users, they might be left to work out their own salvation, and agreed with Mr. Stott as to the impracticability of purchasing power from a local company in the case of an emergency.

THURSDAY AFTERNOON SESSION.

A paper on "Commutating Pole, Direct-Current Railway Motors" was presented by E. H. Anderson. This describes the development of the railway motor, showing how the various mechanical problems have been solved, so that finally the design was reduced to one of securing sufficient ventilation. Later, by other improvements, the output of the motors was further increased, so that commutation again became the limiting factor. To meet this condition the commutating pole has been reintroduced, this being a small pole placed intermediate between the main poles and excited by a series winding, so as to provide at all times a field which not only balances the armature reaction, but is just sufficient for reversing the armature current during the period of short-circuit. Working in this direction it has been possible to design railway motors for voltages higher than 500. Railway motor commutators, before being connected to the armature winding, are tested from bar to bar with from 400 to 500 volts alternating current, which means a maximum of forty per cent more, so that the actual jumping current from bar to bar on a clean commutator will not occur at less than 500 volts per segment. An ordinary commutator of 111 segments and four poles would, under these conditions, be good for 13,000 volts between brushes. The limiting condition, however, is the voltage per bar which will maintain an arc already established. This is largely dependent upon the condition of the commutator, which, in turn, depends upon the deteriorating tendencies, such as sparking and other causes. If the spark be eliminated, as, for example, by means of the commutating poles, much higher average voltages per segment may be used. The usual non-commutating-pole railway motor of from forty to fifty horse-power has a commutator nine and one-half inches in diameter, with from 111 to 125 segments. The average potential between segments is approximately eighteen volts. Large motors operating at 650 volts have from 155 to 165 segments, the voltage between segments being approximately seventeen. Assuming that the average volts between segments for commutating-pole motors may be taken as twenty-four, if the number of commutator bars per inch of circumference is five, it is possible to design a forty-horse-power motor with a nine-inch commutator for 850 volts. A seventy-five-horse-power motor with an eleven-inch commutator will operate at 1,040 volts, and the larger sizes at correspondingly increased potentials up to 250 horse-power, which, with a commutator of eighteen inches, should operate at 1,700 volts. As the interurban cars are usually provided with motors of about seventy-five horse-power or larger, 1,200 volts may be assumed as a good operating potential. This is for a four-pole design. If a two-pole design be adopted, 2,500 volts per motor might be employed. By placing two windings on one core, and a commutator on each, and connecting the windings in series, a 5,000-volt motor is obtained, and with a double-track railway and the rail neutral, 10,000 volts between the trolley wires of a three-wire system might be employed. It is assumed that for city service 600 volts would be limiting, and for interurban service, 1,200 volts would be used.

G. S. Dunn, in opening the discussion, said that the interpole design is not new; that there seems to be a tendency at times to run too fast, and to apply a particular feature suitable for certain conditions too widely. The commutating pole is good for railway motors, for turbo-generators, and a few other conditions where the heating of the motor is not the limit of the output, but for constant-speed work the simple shunt-wound type is, in his opinion, the best.

Replying to several questions, Mr. Anderson said that contracts have already been taken by the General Electric Company for furnishing these 1,200 volt motors for several roads; that the motors have been tested on the stand and operated at 1,800 volts with perfect satisfaction; that on the standard 600-volt motor about one and one-quarter inches is allowed for flashing distance. In some cases it is less than this. On the new motors about two and one-half inches is allowed, which is thought to be more than sufficient.

S. S. Wheeler, the chairman of the Committee on Code of Ethics, then presented the report of this committee. He read in full a proposed code, outlining principles for professional conduct for the guidance of the electrical engineer. These include general principles, the relations of the electrical engineer to his employer, customer or client, the ownership of the records of his work, his duty to the public and the engineering fraternity and to the standards of his profession. The chairman said that the present report was merely a starting point, and he offered a resolution that the code be adopted by the convention and recommended to the members of the Institute for their guidance. This motion was seconded by William McClellan.

H. G. Stott said that it did not seem to him advisable that a matter of this kind should be decided by the vote of three or four hundred men; that it would be better to obtain a letter ballot. He objected to a number of clauses in the code, which seemed to him not at all desirable. The rules in many points were much too specific. Often fine points were drawn which he could not appreciate, and he moved an amendment to Dr. Wheeler's motion that the code be referred back to the committee to be broadened, and that the sense of the members of the Institute be obtained by a letter ballot.

G. S. Dunn objected to the amendment, and moved an amendment to the first amendment. A parliamentary tangle resulted from this, the final action of the convention being, however, to vote to adopt the code. It may be stated here that at the following session of the convention, held on Friday morning, it was shown that according to the new constitution which says that no convention shall take any action which affects the policy of the Institute, this action of the convention was questionable. A point of order was raised, and it was ruled by the chair that the previous action of the convention did affect the policy of the Institute and was therefore unconstitutional, and hence the motion to adopt the code was null and void; whereupon the code of ethics was referred back to a committee, and President Sheldon reappointed the original Committee on Code of Ethics, which was instructed to report upon a code to the board of directors.

Those who took part in the discussion, besides the ones mentioned above, were H. W. Buck, R. W. Pope, C. P. Steinmetz, C. W. Ricker, C. W. Stone, Carroll Thomas, C. F. Scott, W. L. R. Emmet and N. W. Storer.

Professor Henry H. Norris, of Cornell University, read a paper entitled "The Attitude of the Technical School toward the Profession of Electrical Engineering."

The author gives a résumé of papers on education which were read before the American Institute of Electrical Engineers in 1903. He says that a magnetic analogy of technical training may be drawn of the proper limits, as nothing is given to the student by such training, but his inherent powers are merely developed. If too much force be exerted upon him, he becomes saturated and does not respond correspondingly. The problems of technical instruction are to meet the demands of the employer, to attract and retain those men qualified for technical work, and to select such studies as will stimulate his development and mind in the proper way. A short historical sketch of technical schools is given, the growth of Sibley College in particular being described. The present curriculum at this college is explained. Here the work is divided into three parts—experimental, analytical and graphical. The student obtains data from the laboratory; his theoretical training teaches him the analytical method of applying physical laws, and the graphical method which is applied in the computing room brings these two together, it being shown that the theory and facts are in agreement. Some statistics which have been collated from graduates of Cornell are given. One rather striking point brought out is that no one of the many replies received said that any technical information received from the college had been useful. The greatest gain was in the habit of scientifically attacking and solving problems as they arise. It is shown from this that any technical training affects the mental elements favorably, and the following arrangement is given as that of their relative importance—honesty, perseverance, accuracy, thoroughness, energy, initiative, address, loyalty, self-confidence, conciseness, alertness. General adaptability and the faculty of securing information, when needed, along any line are also important.

Following this, another paper on education was read, this being by Professor V. Karapetoff, also of Cornell University, whose subject was "On the Concentric Method of Teaching Electrical Engineering." Professor Karapetoff thinks that while the subjects at the present time given in the engineering curriculum are good, that their order is not logical nor according to psychological principles. He suggests that this be revised, and the student begin by taking up during the first year the general engineering subjects and general culture; and that but little special work in the branch of engineering being followed and in the auxiliary sciences be given. This is to be done by a general review of the field, point out its aims and methods of working. During the subsequent years the amount of special engineering work and of the auxiliary sciences is to be increased, the general culture and general engineering being decreased, so that in the senior year the student's time will be largely taken up in the study of auxiliary sciences and in his special branch of engineering, and in elective studies. This method, it is thought, will give a thorough training to the student, will maintain his interest, and will enable him to decide intelligently which branch of engineering he desires to follow.

The discussion on these two papers was taken up simultaneously.

Professor H. B. Shaw, of the Missouri State University, agreed with Professor Karapetoff that certain changes are desirable in the method of teaching engineering. He did not approve of the remedies proposed. He thought that the student could not grasp the apparatus and methods to be discussed in the first year without having some preliminary training in science and the allied subjects; that it was desirable for students to obtain their engineering knowledge during their vacations, if possible, by obtaining employment on engineering work. He thought that one difficulty lies in the methods followed in teaching the auxiliary sciences. Since electrical engineering deals largely with the transformation and transmission of energy, physics and chemistry should be taught from the view-point of the laws of energy changes.

Professor F. B. Crocker, of Columbia University, New York city, did not agree with Professor Karapetoff's proposal, as it is opposed to experience and history of

education. He believes that principles should precede practice; that a man must be trained to be capable of abstract reasoning, and it is essential that he should be taught to do what he does not like. In other words, the instruction given is intended largely as a training rather than to impart information. He thinks that physics, chemistry, mathematics and mechanics should be taught for themselves; otherwise the student can not get a thorough, unbiased insight into their principles.

G. S. Dunn thought that the plan outlined by Professor Karapetoff was too radical for immediate adoption, but certain suggestions might be taken up in the aim to correlate the studies. He made a point here that all of the so-called learned professions have gone forward during the last few years, with the exception of the law, which is lagging.

President Sheldon, of the Polytechnic Institute of Brooklyn, said that one of the troubles in teaching engineering is in securing instructors who know how to present the subject. The proper man can do this in an effective way and still maintain the interest of his students. A difficulty here lies in the relatively lower salaries paid to teachers, and until the standard is raised, it will be impossible to retain the best men for teaching; in fact, were it not true that many teachers to-day prefer teaching to all other work, the schools would be in a bad way.

Professor William Esty, of Lehigh University, agreed with Professor Karapetoff that it is necessary to give the student something concrete in the first years of his work. Principles are more difficult to teach than facts; hence it is desirable to give some facts when teaching principles. The method employed at Lehigh is to open a summer school, which lasts for four weeks, during which a study of apparatus is made. The object of the training at Lehigh is to fit the student to solve any problem, rather than to fill him with information.

Professor G. W. Patterson, of the University of Michigan, thought that the object of the engineering training should be to turn out an educated man. The course should therefore be laid down with the object of training the man rather than that of amusing him.

In closing the discussion, Professor Karapetoff said the idea in laying out the course was to work from the simple to the complex; that the young man of to-day can grasp the idea of the electric motor more easily than the student of a few years ago could understand the idea of unit pole and a magnetic field. What is needed is a psychological method which will assure the cooperation of the students. Mechanics and physics should be started easily, and then advanced in stages, the purely theoretical being taken up finally. He said that his ideas had been based upon the newer methods employed in the elementary and primary schools.

Upon motion of C. F. Scott, a motion was carried instructing the president to appoint an educational committee.

The report of the Committee on Standardization Rules was then submitted. As this was a simple revision of the report submitted at the Milwaukee convention last year, discussion was not in order, and the report was adopted as submitted.

FRIDAY MORNING SESSION.

The Friday morning session was opened by President Sheldon at 9.45.

H. G. Stott made a point of order that the action of the convention on the code of ethics was unconstitutional. As already explained, the result of this was the referring back of the code to the committee, with instructions to report to the board of directors.

William Cooper read a paper entitled "Regeneration of Power for Single-Phase Electric Railway Motors." For a motor to be able to return power to the line it must be capable of generating a pressure greater than that impressed, and this excess pressure must be under control. There must be, at the time, other power-consuming devices connected to the supply circuit. For a motor to operate successfully as a regenerator of power it must be capable of operating through a wide range of variations between field and armature current, and it must be provided with some means of producing a shunt characteristic. The first characteristic exists to the fullest extent in a motor having some means of compensating for armature reaction, as well as a means of maintaining a constant commutating condition. The second characteristic can be obtained in the direct-current motor by providing the motor with both a shunt and series winding, either of which is sufficient alone to operate the machine as a shunt-wound generator or as a series motor. In the single-phase, alternating-current motor of the series type these necessary characteristics are inherent. The compensating winding neutralizes the armature reaction, and the shunt characteristic is easily obtained in connection with the transformer used in the voltage control of the motor.

The method of producing this result is to use one of the motors of the equipment as an exciter for the others. By providing the transformer with suitable taps, the value of the field current of the exciter may be varied through a wide range, as well as the generated voltage of the restored power. Another method is to provide a separate source of excitation, all the motors being used to the fullest extent for the regeneration of power. With the former arrangement, assuming the equipment to consist of four motors, the regenerating capacity will be equivalent to three-quarters of the equipment. With a separate source of excitation all the motors can be used to the fullest extent for the regeneration of power, and since this method of excitation enables the power-factor of the motors to be improved, the capacity of the machines as generators will be greater than that when operating as motors. Diagrams are given of arrangements thought to be suitable for carrying out this application. A large number of switches is used, so as to give a gradual control of the regenerative action. The efficiency of the system will depend upon the character of the road. In some cases it may be as high as fifty per cent. Under ordinary conditions it probably would not exceed twenty-five per cent. It is thought, however, that the value of this system will lie more in the saving in wear and tear and in the ability to operate on down grades over a wide range of speeds than in the saving of power. It will also increase the safety of operation. Numerous stand tests have been made of this system, which have shown that the motors operate satisfactorily under the proposed conditions.

W. I. Slichter said that this feature of the single-phase motor is one of its valuable properties which will help to bring it into the field of heavy railway work. There are two points at which the control of the power may be applied—that is, by varying the excitation of the exciting motor or varying the excitation of the regenerating motors. This being the case, he thought that the number of taps and switches proposed might be reduced beneficially. When operating as generators there is a tendency for the power-factor to be lower than when running as motors, but this can be overcome by over-excitation. This is an advantage, as then power is returned to the line rather than volt-amperes.

L. B. Stillwell thought that the importance of recuperation is not fully recognized in this country. It not only saves power, but, what is more important, re-

duces the wear and tear of the rolling stock. For this reason alone the Baltimore & Ohio Railroad had contemplated, a few years ago, an electric system of operation over a mountain section, and the late President Cowan had stated that the road would be justified in adopting the three-phase system for this section. Mr. Stillwell said that the system of regeneration would enable the speed on down grades to be controlled at that for which the track was laid, and an average speed of thirty miles would be as safe as ten. There would therefore be no reason for letting out the train on the straight runs, and slowing up when approaching curves. He thought, however, that Mr. Cooper's plan, as outlined, carried the flexibility of the system to an excess. It would be better to simplify it somewhat and have fewer gradations in speed. There seems to be a tendency in single-phase railway work towards complicated switch gear, which is, of course, undesirable.

In replying, Mr. Cooper said that the question of complication is one which must be decided by practice. The easier the control, the less the wear. The plan, as outlined, provides for a sufficient number of switches to meet all possible conditions, and if found unnecessarily large, they can be reduced.

A paper on "Fractional Pitch Windings for Induction Motors," by C. A. Adams, W. K. Cabot and G. E. Irving, Jr., was read by Mr. Adams.

This outlines the theory of this type of winding, and takes up in detail the various factors, such as zigzag leakage, belt leakage, coil end leakage, coil end reactance, slot reactance, etc. The authors sum up the study as follows: The effects of a fractional pitch winding are to reduce the several components of the leakage reactance, to reduce the over-all length of the motor. In some cases a considerable gain in the convenience of winding, as well as a saving of space, are obtained, and a decrease in the exciting reactance is secured.

This was followed by a paper presented by R. E. Hellmund, entitled "Zigzag Leakage of Induction Motors," which was read in abstract by A. S. McAllister.

In a study of induction motors, the leakage coefficient is one of the most important factors. Unfortunately, the definition of this value is not fixed in practice, some writers using one expression, others another. These are discussed, and expressions derived showing the relation between the different factors as used. The author then takes in an analytical investigation of the leakage of induction motors, treating the magnetic circuits as elecric circuits connected in multiple. He gives diagrams showing the application of the formulæ which he thus deduces, and calls attention to the fact that the leakage coefficient varies with the load condition, which makes it rather difficult to obtain an exact value for the various conditions between the no-load and blocked rotor conditions. He points out also the effect of load currents combined with magnetizing currents, affecting the general wave shape before any final conclusions can be drawn. The expressions which he derives for the leakage coefficient are somewhat more complex than those in general use, but it is held that this is not a serious matter, because it is worth while to spend a little more time in making the first design of a motor if in that way it is possible to obtain a more accurate estimate of what the factor will be. For everyday design, on a standard line of motors the leakage coefficient is known, so that there is no need of predetermining it.

It was pointed out, in the discussion of these papers, by C. W. Stone that when a fractional pitch winding is employed, the extra insulation between the coils plays an important part. This is true both as regards generators and motors. Most machines are now built with a fractional pitch, and this extra insulation is graded from end to centre of the coil.

Mr. Adams, in reply, said that this feature was one which had not been taken up in the paper. In reference to Mr. Hellmund's paper, he said that it gave a very complete study of the zigzag leakage factor, and included many points not taken up in previous considerations. He thought, however, that the same results might be obtained in a simpler manner.

W. I. Slichter read a paper entitled "The Vector Diagram of the Compensated Single-Phase, Alternating-Current Motor."

Although the compensated single-phase motor is simply a series circuit in physical connection, there are incidental reactions which have the effect of a combination of series-parallel circuits. These reactions affect the efficiency and power-factor sufficiently to warrant a careful analysis of their character and cause. This is made, and a vector diagram evolved which takes into consideration all of these reactions which go to influence the final result.

This paper was discussed by V. Karapetoff, who said that he had presented to the Institute in 1903 or 1904 a circle diagram of a single-phase motor which was a development of the well-known Heyland diagram for the induction motor. It had been found, however, that due to the saturation of the iron the locus of the apex of the triangle was not a semi-circle, but is the arc of a circle of which the short-circuit current was a chord. This article is easily located from tests upon the motor.

FRIDAY AFTERNOON SESSION.

L. Frederic Howard read a paper entitled "Track Circuit Signaling on Electrified Roads." He sketched the development of the track signaling circuit from its adoption on steam railroads to the present systems adapted for electric railway use, where the propelling current is either direct current or alternating. He described briefly some of the appliances used in such work, and gave a number of diagrams illustrating various systems. He pointed out that when an engineer is asking for estimates for a track signaling system he should give definite information regarding certain features. One of these is the track leakage through the ballast, and another is the amount of unbalancing of the two sides of the track which must be allowed for.

C. F. Scott called attention to the way in which signaling work has followed the intrusion of different elements into railway operation. He also called attention to the high grade of engineering work which has been done by the signal engineers, and the great amount of ingenuity that has been exercised in meeting and overcoming many difficult problems. He said that one disturbing element recently encountered is the intrusion of foreign direct current into the return rails of alternating-current systems.

H. G. Stott said that few engineers know anything about signal work. This has become a highly specialized branch of engineering, calling for the greatest skill. What had been done is well illustrated by the experience of the New York subway, in which there is only one failure in about 4,000,000 operations, and this failure does not mean an accident. He believes that all roads must come to the automatic system, as they must eliminate the human element, which, however carefully trained and conscientious, fails sometimes at critical moments.

Professor C. A. Perkins said that he believed the time was coming when automatic agencies should be extended beyond the signal and should cut off power from the train when the signal is set at danger. It was pointed out by Mr. Stott and Mr. Howard that this feature has been

adopted on the New York subway and on the Boston and Chicago elevated roads, Mr. Stott saying that a train operator never runs past a danger signal but once, as this action turns all the air-brakes on all the cars, thus forcing him to get down under the train and open the valves by hand.

A paper by F. G. Baum, entitled "Some Power Transmission Economics," in the absence of the author was read by title.

The author says that in designing power-transmission systems it is always well to bear in mind that the ultimate development of the art and the country has not yet been reached; that it is never advisable to build branch lines on the extensive plan necessary for the main line. He then discusses many details of line construction, describing certain economical methods which he has put in operation. One of these consists in extending the pole top, thereby enabling longer spans to be used by eliminating every other pole. Thus, the cost for insulators, pins, etc., is cut in half. He discusses in some detail types of oil switches which have been tried, describing those which have been adopted for his system. He points out that in some cases the engineer is called upon to erect a system which he knows will be used but a few years. In such cases it is the business of the engineer to put in that system which will accomplish the work satisfactorily with the least amount of money.

In discussing this paper C. P. Steinmetz said that there seemed to be a geographical difference of opinion regarding what may be considered reliability; that practice which is acceptable on the Pacific Coast would not be considered in the East; therefore, in any such paper the author should attempt to define what he means by reliability. He should give the number of interruptions and their duration which may be allowable. He asked whether there is a 60,000-volt transmission system which, according to eastern standards of reliability, may be considered satisfactory. If no interruptions are allowable there is none, but if the interruptions do not amount to more than one per cent of the time, there are.

F. B. H. Paine thought that Dr. Steinmetz was asking too much of the transmission engineer; that the permissible interruptions depend a great deal upon the system's customers. Mr. Baum's paper brings out sharply differences in practice in the East and in the West. One of the most striking of these is the use of the ground as a return for high-voltage systems and the omission of automatic switches for protecting the line. Under these conditions apparatus may be used which could not be installed if automatics were employed. The oil switches described by Mr. Baum are much cheaper than those employed in the East, and apparently give satisfactory results. These, however, are operating, and not emergency switches. He asked whether there was not some objection to employing the ground as a return when there are so many different operating voltages in use. He does not think that when two pole lines enter a city from different points that it can be held that the reliability of two independent lines is obtained. He had asked why different tensions are employed for the different wires of a line, and it was explained that this was to prevent the wires from swinging together. No such trouble has been encountered in the East.

The Convention of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 25-28.

A paper by E. J. Young, on "One-Phase High-Tension Power Transmission," was presented by title.

The author calls attention to the recent advance in Europe of the Thury direct-current system of power transmission, and says that this demonstrates that unless an alternating-current system approaching it in simplicity of design and economy of material be developed, it is only a ques-

tion of time before the high-tension direct-current system will gain a foothold on this continent; consequently, he proposes a high-tension one-phase system having several desirable features not in common with either the direct-current or the three-phase systems. He says that, considering the strain upon the insulators as the standard of comparison, the direct-current system has an advantage that no alternating-current system can overcome. A single-phase high-tension system has, however, the simplicity of the direct-current system, and, besides, is more flexible in the ease with which it may be transformed. He discusses the relative costs of the direct-current single-phase and polyphase alternating-current lines, and shows that the direct-current and single-phase systems are superior to the polyphase. As regards weight of conductors, the single-phase system is on a par with the polyphase, both being much more expensive than the direct-current system. The system, however, is sadly at a disadvantage, due to the inability of operating large induction motors. There might also be greater liability of surges. The number of transformers, however, is much less, switching arrangements far simpler, and by grounding the centre of the system it would be possible to operate on one wire, the ground acting as a return.

C. P. Steinmetz said that some years ago, when the limiting tension was that placed upon the insulators, that the economy of the three-phase system in copper was greater than that of any other. If, however, the limiting strain be that between the wire and the ground, the point of view is altered; and accepting this criterion, the three-phase system, the four-wire, quarter-phase system, and the single-phase system are on an equal basis. The advantage of the three-phase system now lies in its greater usefulness for the sale of power and the advantage of three wires over four as compared with the two-phase. Comparing with the direct-current system, the maximum voltage permissible with the latter gives it a greater economy in copper, but there are other limits to be considered, and further investigation of the reliability of the direct-current system is necessary before a decision can be made in its favor. He does not think it will be adopted in this country.

C. F. Scott also thinks that the American engineer is not inclined toward the arrangement of machinery necessary for the high-voltage, direct-current system.

This being the concluding session of the convention, the usual resolutions thanking the local committee and the local companies for their courtesy and entertainment were carried, on motion of H. G. Stott.

President Sheldon then declared the twenty-fourth convention adjourned.

The social features of the convention consisted of a trip through the Niagara Gorge on Tuesday afternoon, a tea at the Natural Food Company's Conservatory on Wednesday afternoon, an automobile trip for the visiting ladies on Thursday morning, and a reception at the Cataract Hotel on Thursday evening. Many of the members took advantage of the opportunity for visiting the large industrial establishments at Niagara Falls, particular interest being shown in the new Canadian power-houses.

Vickers, Sons & Maxim's Sheffield Works.

The Sheffield, England, works of Vickers, Sons & Maxim, says *Electrical Engineering*, London, June 20, is one of the most notable examples in England of the use of the electric drive. Here the motor drive has been adopted almost universally, resulting in a great saving in transmission losses, in the expense of belts and line shafting, and in the convenience of the shops. Where desirable, variable-speed motors have been employed, whereby a large increase in the output of the tools has been secured. In certain cases the variation in speed is from six to one, although the average is about three to one. One particular application of this is in securing a quick return of the tool on the back stroke. At these works large gains are made, and some of the operations require a long, slow stroke. The return may, however, be at a greater rate. This is done by utilizing the variable-speed motor. A stop placed on the machine automatically reverses the motor and changes it from a low to a high-speed connection, so that the return stroke is made quickly. For instance, a rifling machine which cuts at the rate of from ten to fifteen feet a minute is returned at thirty feet per minute. There are in these shops some notable examples of machine tools. Some of the lathes, for example, are 110 feet long, and driven by individual motors. An interesting machine has been developed for grinding operations, intended particularly for finishing armor plates. Here the grinding disc is driven by a motor mounted in a special frame, whereby it may be tilted to any desired position. The works are equipped with a number of electric hoists for handling various materials, there being altogether about 200 motor-driven cranes and hoists. A most noteworthy example of these is a traveling transporter or bridge built across the river Don to connect the works with a plot of ground on the other side of the river, upon which pig-iron is deposited as it is delivered. The transporter bridge is practically a cantilever bridge mounted on two gantrys which run on rail tracks, one on each side of the river, and 187 feet apart. Each end of the bridge is extended beyond the gantry. At the works it reaches forty-five feet over a railway siding, and in the yard it projects 187 feet. The maximum width of the river at this point is 120 feet. A single eighty-five-horse-power motor actuates the traveling hoist and conveying gear, and is controlled from the cab. This motor runs at 265 revolutions, and is mounted on the truck of one of the gantrys. It drives the wheels of the gantry on the other side of the river through bevel gearing and shafting. A wire rope actuated with two drums on the same shaft pulls the trolley from one end of the bridge to the other. A single drum is used for hoisting. The load is five tons, the traversity speed, 700 feet per minute, the hoist speed, 250 feet per minute, and the speed of travel, 100 feet per minute. Details are also given here of several types of smaller cranes and of some of the electrical machinery there used.

Empire State Gas and Electric Association.

A meeting of the Empire State Gas and Electric Association was held at Lake Champlain, N. Y., June 27, the subject of the meeting being the relation of the public service companies to the Public Utilities bill. The meeting was presided over by T. R. Beal in the absence of the president.

The publicity work of the association was described by H. H. Curran and discussed by several in attendance.

Following an analysis by J. N. Shannahan of the features of the Public Utilities bill, a lively discussion ensued culminating in a motion by J. M. Wakeman that a public utilities committee of three members be appointed for the state to work in conjunction with a committee which might, upon suggestion, be appointed by the Street Railway Association of New York State. This motion was adopted. The committees will report at the annual meetings of their respective organizations.

The subject of uniform accounting was taken up in a paper by Bernard V. Swenson and C. H. Hart, and Rolland A. Davidson read a paper on fire and liability insurance of gas and electric companies.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Light Alloys.

In this one of a series of articles dealing with various alloys A. H. Sexton discusses the light alloys, the most important of which are those containing aluminum. Aluminum itself has a specific gravity of 2.58, and is the lightest of the metals in common use. Unfortunately, its properties are such that in the pure state it is unfit for purposes where it is likely to be subject to stress or wear as it is weak and soft. It may, however, be strengthened and hardened to some extent by the addition of foreign constituents, without its white color being impaired or its weight seriously increased. The purer the aluminum the softer it is. The metal now produced by the electric processes is very pure and therefore very soft. Silicon may be present accidentally, or may be added. This element hardens the metal and at least one of the light alloys on the market is simply aluminum containing a little silicon. When the amount of silicon is over two per cent the color is impaired and it becomes less malleable. The principal metal for hardening aluminum is copper. Alloys of the two metals are largely used. Although copper has a dark color, it does not seem to modify the color of the aluminum in the slightest when only present in small quantities. Alloys containing ten per cent of copper still retain the white color of the aluminum. The specific gravity of the alloy is increased by the addition of copper, but the increase is small, so that when under ten per cent it alters the weight of the metal but eight per cent, the specific gravity being less than 2.9. The tensile strength increases with the percentage of copper. The elongation rapidly decreases, the metal becoming harder, less ductile and more brittle. Tests for corrosion show that the presence of copper tends to increase rather than decrease this. Nickel alloys of aluminum in small quantities harden the metal very much. Richards states that nickel-aluminum alloys have been made with a tensile strength in castings of 30,000 pounds to the square inch, and 50,000 pounds in rolled bars or plates. This metal possesses great elasticity and would seem suitable for springs for light vehicles. Nickel-aluminum alloys generally resist corrosion well. Copper-nickel-aluminum alloys are sometimes made. These are occasionally used in Germany. Iron is a very constant impurity in aluminum. A small quantity darkens the color and hardens it considerably, making it less malleable and causing it to crystallize more readily. Tin and aluminum alloy readily. When the quantity of aluminum is large and that of tin small, the resulting alloy is very brittle. With a larger quantity of tin the alloy becomes stronger. Zinc and aluminum readily alloy, the alloys being in general harder and more fusible than aluminum. A small quantity of zinc is sufficient to make aluminum brittle, and the alloys are of no practical value. The addition of a small quantity of tungsten to aluminum has been recommended by Mannesmann as improving its resistance to corrosion and greatly increasing its strength.—*Abstracted from the Mechanical Engineer (London), June 22.*

Wireless Telegraphy and the Solution of the Problem of Selectivity.

A method of securing selectivity, or at least of enabling the operator of a wireless telegraph system to sift out the messages which he receives, is described here by I. Hettinger. The principle proposed depends on the fact that the ratios of any two or more values of a resonance curve corresponding to different frequencies of the receiving oscillatory circuits do not substantially change whatever the absolute values of the energy received may be. This offers a characteristic of selectivity which is substantially independent of the power and distance of transmission. One mode of applying this principle consists in inserting in two or more oscillatory circuits two or more quantitative detectors operating, respectively, two or more indicating devices. When this is done and two messages of different frequencies are simultaneously received by one and the same station the two indicating devices will conjointly show the induced double effects in three different ratios, one corresponding to the signals of one frequency, the second to that of the other, and the third due to the superposition of currents. These three ratios are obtained according to the time interval when the parts of the signals of each frequency are received with and without superposition. Thus, the signals of one are made to read from the one ratio in the conjoint indication and from the superposed effects, while the signals from the other frequency are to be read from the other ratio and the same superposed effects. The arrangements adopted may vary considerably. Several arrangements are shown, suitable for applying this system. The detector and indicating devices employed may be quantitative apparatus or apparatus which can be so used. In order to make the coherer a quantitative apparatus a plurality of coherers in parallel may be employed, these being adjusted to have different sensitivenesses. In this way the number of detectors working at one time is different, according to the energy received. The author has worked out a practical arrangement, according to the principle proposed, which consists in the combination of the two detectors with one indicating device in a differential manner.—*Abstracted from the Electrical Engineer (London), June 21.*

Gas and Electric Power in Continental Iron and Steel Works.

As a general rule, says J. B. van Brussel, every important iron and steel works in Europe using electricity has its own electric power generating station. This is equipped with either reciprocating engine generating sets, steam turbine sets or gas-engine sets. Steam driving, within the last four or five years, has been confined almost exclusively to the type first named. More recently the steam turbine has come forward as a competitor in this work, particularly where large units are installed. Electric motors are now extensively employed for driving blast furnace hoists. For this purpose it is necessary that the motor should start frequently, and some form of starting gear must be provided which can be readily controlled from a distance. Starters driven by motors or with solenoids for actuating the different contact steps have been used, but they have the disadvantage that considerable power is lost in each resistance at each

start. There is also some difficulty with this method in arranging for the cage to stop exactly at the right level, so that the trucks may be conveniently wheeled off. To accomplish this result a method of control must be employed which permits of gradually retarding the hoist until a very low speed is reached, the current being finally broken and a holding brake applied at the exact instant when the cage arrives at the floor level. The most perfect method of accomplishing the above result, and also saving practically all rheostatic losses at the beginning of each hoist, is to use a motor-generator set running constantly and controlled according to the Ward Leonard system. The field of the generator is controlled by a small rheostat placed conveniently for the operator, by means of which a varying voltage is applied to the armature of the hoist motor. The rheostat is best placed on the hoist guides in a position convenient for operating, and to the cage are fixed cams, which automatically shut off the rheostat and gradually reduce the speed of the cage as it approaches the floor level. At the exact instant the cage reaches the floor level, a raised portion of the cam forces the rheostat handle to the off position, thus breaking the circuit and applying the holding brake. No method of absorbing the energy of the moving mass with mechanical brakes will be found satisfactory for stopping a cage at a fixed point, as even small changes in temperature of the brake will vary the distance run by the cage. An amplification of the voltage control method described above is to provide a small flywheel direct-coupled to the motor-generator. The method of control remains the same. The introduction of the flywheel serves to equalize the load and reduce the demand upon the generating station at the beginning of each hoist. Motors are also used for operating blast furnace bells. In one type of these the winch consists of two drums which are driven through worm gearing by a motor of either the three-phase or continuous-current type. The wire rope which actuates the mechanism for moving the bell is divided where it passes over the drums into two ropes, each of which makes one turn about one of the drums. By thus dividing the rope, a smaller diameter of the drums is permissable. The rope, after lifting the drum, is connected to a counterweight. For starting the motor in one direction the bell is lowered until its further motion is limited by a stop. The motor may then continue to revolve, but as the rope, on leaving the drum, becomes slack, the weight of the bell being taken off by the stop, slippage between the rope and drum occurs, and the counterweight is lifted no higher. Upon reversing the motor, the bell is closed, and at this instant the counterweight is also brought against a stop, thus slackening the rope at the other end and allowing slippage to occur. When three-phase motors are used for this purpose all that is required is a simple reversing switch. Electric motors have further been used to a considerable extent for tipping bessemer converters. This problem presents no special structural difficulties. Driving the live rolls presents probably the most severe work in iron and steel works. When electric motors are applied to this, two methods of reducing the severity of the shock may be employed. One way is to use tight and loose belts, which allow of a certain amount of slippage. The other is to build the motor so durable that it can withstand the highest overloads thrown upon it. The latter is the method now generally being employed. Motors for this work are built on simple lines, the frames being made specially heavy and rigid, so as to prevent any yielding. The motors employed are either of the direct or three-phase type. A type of starting resistance coming into use in Europe is known as the hot-water starter. It consists of an iron tank divided into two sections, one of which encloses the electrodes held in a fixed position. The other contains the starting electrolyte. Starting is effected by means of a circulating pump, which draws the liquid from one compartment and forces it into the other, the resistance varying according to the height of the fluid. As a comparatively small amount of water is employed, this is quickly brought to a boiling point, and heat is carried off by conducting away the steam thus generated. The advantages of this are its simplicity, ease of control and its relatively small size. For the main reversing rolls the Ilgner system is coming into use, in order to reduce the shock of the reverse on the main supply system. This system, which has been described frequently, depends upon the use of a motor-generator with proper characteristics, connected to a heavy flywheel.—*Abstracted from the Engineering Magazine (New York), July.*

The Separation of the Iron Losses in Asynchronous Motors.

A common way of separating the losses of induction motors consists in taking what is known as retardation or running-down curves, power being cut off from the rotor, and the rate at which it comes to rest being noted. When the friction of these machines is a considerable portion of the total rotor loss, this method becomes unsatisfactory, and a method of testing under such conditions which avoids the errors due to friction is described here by T. F. Wall. The true friction loss is for a given speed, independent of the applied voltage, but all the iron losses must diminish when the flux is diminished. If, then, the machine be allowed to run light with a short-circuited rotor, the power supplied to the stator will be absorbed in iron losses, friction losses and copper losses. If this power is measured for a given frequency and different values of the applied pressure, starting from a pressure above the normal and proceeding to as low a value as possible consistent with steady running, a curve may be drawn which, when reduced back to the ordinate axis, will give the friction loss as the intercept on this axis. In such cases it is advisable that the copper losses be subtracted before plotting the curve, because the current does not vary uniformly with the pressure. To separate the iron losses a reading is taken with the rotor winding switch open when the rotor is running at full speed. This gives the power supplied to cover the stator loss and hysteresis torque on the rotor. To separate the stator iron loss from the hysteresis loss due to the teeth of the rotor, the rotor is driven at different speeds with the winding open, power being supplied to the stator. For speeds below synchronism the hysteresis produces a driving torque on the rotor. At speeds above synchronism it has a retarding effect. Moreover, the hysteresis torque is independent of the speed; therefore, in passing through synchronism the power given to the stator changes instantly by an amount equal to twice the hysteresis torque multiplied by the synchronous speed. Thus, by taking a few readings above and below synchronism, and drawing a curve, a break is found at synchronous speed, and half the amount of this break is equal to the power due to the hysteresis torque at synchronous speed. This enables the hysteresis torque to be separated from the stator iron loss. The author then gives instructions for carrying out the test and for computing values from the readings thus obtained. He also gives a graphical construction for use in these tests.—*Abstracted from the Electrician (London), June 21.*

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

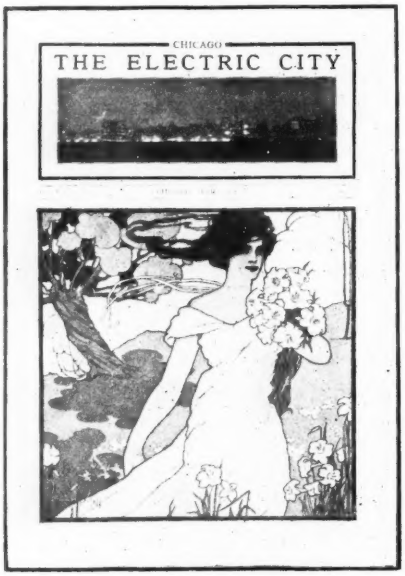
SELLING POWER.

BY E. A. CREED.

When starting a campaign for power business, it is well to send out men who have had experience in meeting and doing business with business men.

The power solicitor or motor salesman need not necessarily be a technical man, but if the services of a man who is strong technically and commercially can be secured, by all means get him, but such men are the exception rather than the rule.

Your technical man is full of engineering lore and would fain unload his technicalities on the poor prospect, who is, maybe, in a receptive mood when approached, but is so bewildered by the awful array of watts, ohms, amperes, joules, power-factors—in short about every term connected with a motor or its driving force, excepting dollars and cents, that he decides he'll put in the gas or steam engine after all.



THE UP-TO-DATE COVER PAGE OF THE CHICAGO EDISON COMPANY'S BULLETIN.

In soliciting power business, a man should use great tact in approaching his prospects.

In canvassing for lighting or heating contracts, one finds that every house needs the electric light, but only a selected few will be found of profit to the central station as power consumers, so let us work trade to trade, business to business.

Small motors, less than a half horsepower, generally come under lighting rates, so the lighting solicitor would handle small motors.

We'll start on the bakers: Visit every baker in your territory.

Tell him of the merits of the electrically operated dough mixer.

Show him how he can save flour, labor, time and money with a dough machine.

Explain how quickly eggs can be beaten with the electric egg beater.

By reading the literature published by the various bakers' supply people, a solicitor will become thoroughly versed on bakers' machinery.

If there are any points that the power solicitor can not explain, then get in touch with the manufacturer of the appliance.

Nine times out of ten he will close the sale for you.

The wood sawyers are profitable prospects. The average cost of sawing a load of wood is about one dollar when man power is used. The electric motor will do the same work for about five cents, depending of course on the rate.

Ice cream manufacturers are profitable during the summer months. Go after them. It costs about two and one-half cents to freeze ten gallons of cream. Get pointers on the ice cream business. A quart of cream, two quarts of milk, and the necessary flavors, etc., will make five gallons of excellent ice cream. The electric motor will give a constant, even motion to the dasher, puffing the mass evenly and solidly. When done by hand the mass will fall flat.

THE PHILADELPHIA ELECTRIC COMPANY CAN ALWAYS BE COUNTED UPON FOR STRIKING AND HANDSOMELY PRINTED LITERATURE.

Argue that if one can make five quarts of ice cream out of three quarts of material by using an electric dasher, the two extra quarts turned out will in a short time pay for the outfit.

Since concrete has become so great a factor in the building business, apparatus for mixing the ingredients has been put on the market. The electric drive is ideal for these machines. They run intermittently and economically. Literature describing the mixers may be secured from the manufacturers.

Butchers, grocers, butter and egg dealers, and general market men may be interested in refrigerating outfits. A power solicitor will find the companies manufacturing the different machines only too willing to send a representative to explain the merits of their respective apparatus. In figuring the motor, take two horsepower for each ton of refrigeration. A small refrigerating plant will cost complete from $850 to $3,000. The little fellow who will perhaps use a two-ton plant can be shown how he can quickly get his money back when he finds that he can

make his ice for $1.50 per ton against the $4.00 to $6.00 he is or was paying the dealer.

We have been considering the users of comparatively small motors.

In large installations the manager of the station will usually make a low rate.

The competing drives are the gas, gasolene and steam engines.

In approaching the man who is using the gas or gasolene motor, it is well to find whether or not the machine is giving satisfaction. Seldom do gasolene engines give their rated horse-power. When the load is heavy, as in freezing cream, the thicker the mass the greater the resistance, so the gas engine will have a tendency to slow down, the dasher run slowly, the mass of whipped cream sags, causing a monetary loss to the manufacturer.

The argument should be used that the two quarts lost at each freezing when using gas or gasolene would be saved if an electric motor, with its steady drive, was employed, and would in a short time pay for the motor.

If the gasolene engine user is a wood sawyer, he will generally have the machine in a shed or outbuilding. In cold weather the engine will freeze. Point out to him that a motor *can't* freeze. It will run during all seasons—summer and winter.

A motor solicitor should have a practical knowledge of motors. He can gain this by study and time spent around motor manufactories, or installation. He should have a wide knowledge of the horse-power necessary to run various machines. The greater his mechanical knowledge, the better impression he will make upon the prospect.

A power solicitor will go up against many hard walls of argument, but there isn't a wall standing but a well-trained gun can hammer it to pieces, so train your guns to hit the weak places in each respective wall.

A Showy Bulletin from the Portland Railway, Light and Power Company.

For instance, "Why, my gasolene engine is costing me but $7.00 a month to operate. Can you beat that?"

"No," you tell him, you can't, but you can reduce his insurance rates, you can minimize the danger he is in of the gasolene exploding, of the parts wearing away; you can guarantee to stop the noise of the exhaust, the vibration of the building, the odor of the fluid, and the trouble of the spark-coil.

You can put a hole through that wall that will never be filled up.

There are 101 additional points that one may bring up in the line of the superiority of the electric motor over any other known drive. Study every line on the subject of the electric and all other drives. Know your enemy as well as your friend.

On big jobs or on installations where steam is required for heating, or other purposes, that gag that they use the exhaust for heat may be met with the argument that a low-pressure boiler together with an electric motor will do the work more economically.

To recapitulate—have a thorough knowledge of your prospect's needs in the power line, know to a certainty the size motor he can most economically use; never sell too large or too small motors.

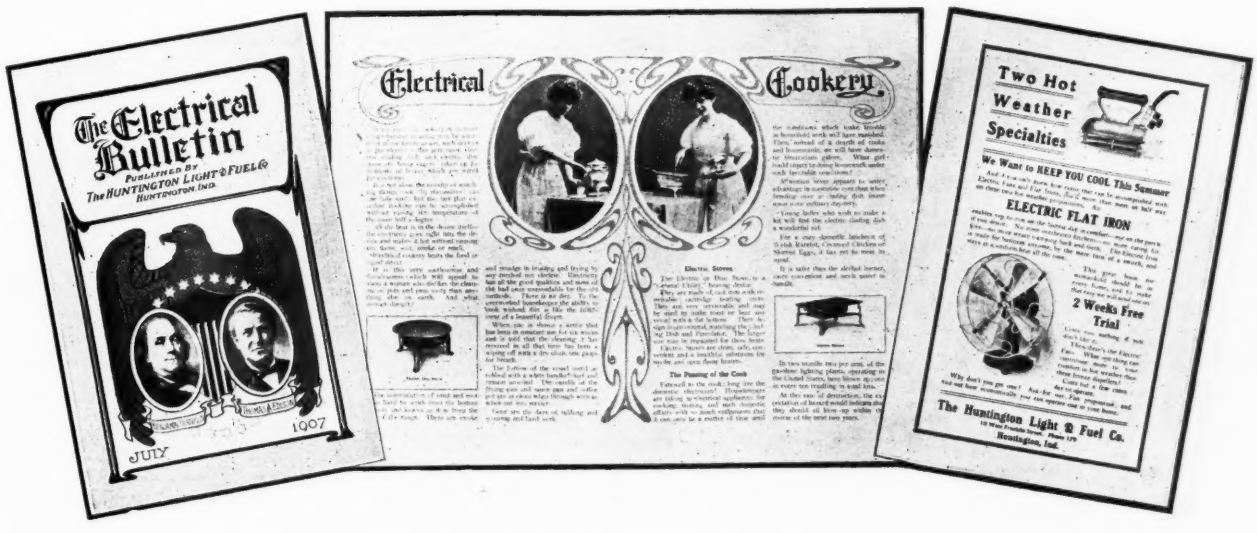
You are selling "juice" primarily.

The best customer is the one whose business you retain indefinitely.

If you put in too large a machine, his meter bills will frighten him; if too small, the fuses will blow, thereby causing annoyance.

If the job is beyond you, then call the expert to figure the power necessary.

It's no reflection on you that you don't know it all. This is a period of specialization.



Huntington, Ind., Holds Old Customers and Interests Prospects with Its Bulletin Service.

A Review of Some New Central Station Literature.

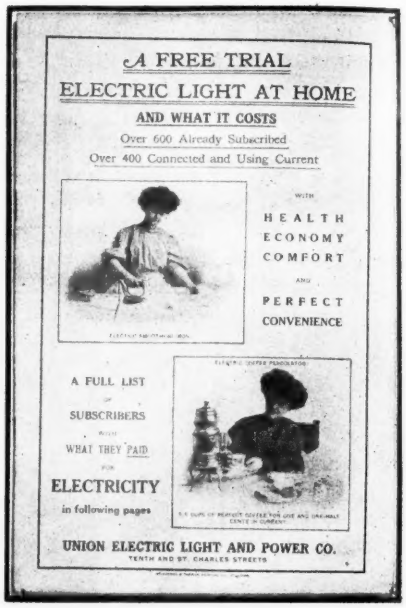
CHICAGO EDISON STILL KEEPING UP THE PACE.—"Electric City," the Chicago Edison Company's excellent monthly, continues to maintain its high standard as a publication devoted to the education of the public on matters electrical.

"TRACING RESULTS."—This is a folder put out by the Philadelphia Electric Company in the interests of its power department, which is at once attention-compelling and argumentatively worthy. It presents the case for electricity concisely and convincingly.

HUNTINGTON, INDIANA, GETS OUT A FINE MONTHLY BULLETIN.—The Huntington Light and Fuel Company, of Huntington, Ind., is showing a truly modern spirit of commercialism and push in the way it is aggressively circularizing its customers and prospects in the interests of electricity. Its beautiful bulletin, of which several pages are reproduced in this department, is one of the most elaborate and interesting examples of central station advertising which has come to our notice, and can not fail to have a stimulating effect on the Huntingtonians in making them desirous of securing electrical comfort in their homes, electrical advertising for their stores and electrical power to turn their wheels and do their work.

Huntington is one of the best little towns in Indiana, and should be an excellent field for the sale of "juice," once the people become educated to the great superiority of electricity. And this is just what this clever bulletin accomplishes; it educates the people and creates the desire for electricity in their minds. It is remarkable in looking over its pages how capitally the whole field of electricity is covered both in the reading matter and illustrations. It is nicely printed in two colors—black and terra-cotta—and the half-tone illustrations are excellent examples of the engraver's art.

A FEATURE OF THIS GERMAN BULLETIN IS THE EXCELLENCE OF THE HALF-TONE ILLUSTRATIONS.



THIS BULLETIN MEETS WITH APPROVAL FROM THE PEOPLE FROM MISSOURI.

The last page is utilized in presenting an attractive special proposition offering electric flat-irons on free trial for thirty days, and asking the public to inquire

A HUSTLING BULLETIN FROM GREAT BRITAIN.

about the special proposition on electric fans. About eight hundred copies of this bulletin are issued each month.

PORTLAND, ORE.—"Public Service," the handsome monthly bulletin put out by the Portland Railway, Light and Power Company, is exceptionally attractive in its handsome June dress of black and sky blue and contains some very readable electrical articles dealing with a variety of subjects. A very interesting illustration is that of the Chinese war junk—the Wang Ho—now on exhibition there.

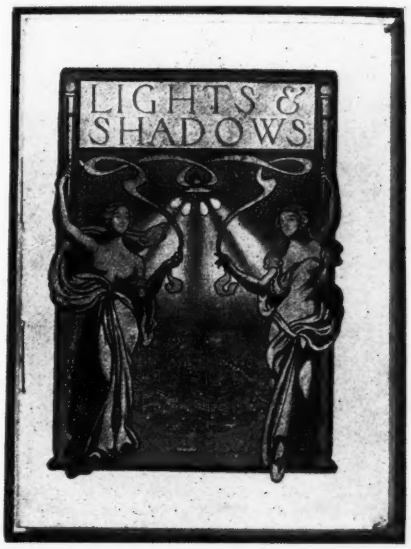
"AUSGEZEICHNET."—"Ausgezeichnet"; that's Dutch for "out of sight," and conveys an opinion of the handsome and clever little monthly bulletin issued by the Berlin Central Station, of Berlin, Germany. Here is a publication which typographically a great many of the bulletins published in this country can take off their hats to. The illustrations are very good.

WHERE THEY HAVE TO BE SHOWN.—The Union Electric Company, of St. Louis, Mo., gets out as often as needed an interesting monthly bulletin. Mr. Wissing, who is the advertising manager for this company, is a man who understands how to attractively present the merits of electricity to a public such as is found largely predominating in a city like St. Louis; that is—a conservative public, a public a little bit inclined to look upon electricity with suspicion and to think that what was good enough for their fathers is good enough for them.

ATCHISON, KANSAS, KEEPS UP A LIVELY INTEREST WITH ITS WELL-PRINTED AND ILLUSTRATED BULLETINS.

Mr. Wissing has succeeded in removing a goodly proportion of this adverse sentiment and the results of good advertising, combined with solicitation, are being reaped more and more as time goes on. He is an able exponent of the art of getting homes wired on the instalment plan and otherwise, and it will pay any central station manager to get into touch with some of the clever and profitable schemes that are being worked along this line by this aggressive company.

ACROSS THE POND.—Yes—over there—they are getting into line too. The "Tyneside Pioneer," while not exactly a central station publication, is very much of an active booster for electricity and is doing its full share in stirring the somewhat sluggish and conservative Briton to a sense of his out-of-dateness and behind-the-timeness in worrying along with gas and the other inadequate artificial illuminants when they should be burning up electricity as their American brethren do.



THE UNITED ELECTRIC LIGHT AND POWER COMPANY OF NEW YORK CITY STILL PUBLISHES THIS ATTRACTIVE BULLETIN.

The publication—while it does not come up to the American standard typographically—is very strongly, brightly and interestingly written. It is published at Newcastle-upon-Tyne, one of the most hustling cities of the United Kingdom—"one of the most American cities," as someone has put it.

A FLIER FROM ATCHISON.—"Cooking by Electricity" is the title of a neat and tasteful little four-leaf folder used by this company, to represent to the people of Atchison the merits of electricity for cooking purposes. It is gratifying to note that the standard of typographical excellence is on the rise in central station advertising. A few years ago what little printed matter was sent out was of the most tawdry description, but to-day it is safe to say that in no field of endeavor is there such excellent advertising to be found, as in the electrical field. And this is as it should be, for what is more worthy of the very highest class of advertising than electricity?

A NEAT CONCEIT FOR A TITLE, AND APPRECIATED BY WASHINGTONIANS AS AN EDUCATIONAL MEANS OF NO MEAN ORDER.

Echo answers, "What?"

"PEPCO NEWS."—"Pepco News" is the title of the bulletin published monthly by the Potomac Electric Power Company and is full of interesting electrical illustrations and reading matter. The handsome cover design which we reproduce represents the standard of excellence in this regard, which is maintained from month to month.

"LIGHTS AND SHADOWS."—"Lights and Shadows" is the fanciful name for the dainty little publication gotten out by the United Electric Light and Power Company of New York. It is a very small booklet, and, perhaps, not quite virile enough to make itself heard in these days of strenuosity, but undoubtedly will make many friends among the ladies by reason of its elegance and daintiness.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

A New Line of Panel Circuits and Switch Parts.

The Trumbull Electric Manufacturing Company, of Plainville, Ct., has recently put out a complete new line of panel circuits and switch parts. This is a line unique in the market and is designed to meet the increasing demand of those who wish to get their own slate or marble and arrange the circuits as they desire.

With these parts a man does not have to depend on the factory for an additional circuit or some slight change.

A New Line of Panel Circuits and Switch Parts.

The freight rates are so much lower on slate than on completed panels that the saving in transportation charges will be influential in increasing the demand for these panel parts.

They are constructed for National Electric Code or plug fuses.

Bus-bars can also be furnished as well as the necessary lugs, so that complete unmounted panels can be obtained.

The Merchants' Association of New York, 66-72 Lafayette street, New York city, is announcing reduced fares for the summer meetings of 1907.

Interesting and Useful Bulletins Devoted to Electric Lamps and Illumination.

Any one who is brought into contact with problems in illumination will greatly appreciate the data and tables compiled for the latest bulletin of the National Electric Lamp Association by its engineering department.

This bulletin, "Data on Illumination," gives a clear explanation of the best methods for calculating illumination and several problems are fully worked out showing the exact procedure. In connection with this, the tables, which not only give such general information as "Required Illumination for Various Classes of Service," "Effect of Absorption," etc., but also materially lessen the actual calculation in figuring both illumination and wiring, make the bulletin of practical value to both the illuminating engineer and those who only occasionally wish to work out problems in illumination. This bulletin is the first one that has been published on the general subject of illumination, the previous issues take up the following subjects in the order named:

Bulletin No. 1, "The National Electric Lamp Association," gives a brief account of the general purpose and aim of the association in its efforts to increase the standard of its product.

Bulletin No. 2, "The Engineering Department," shows how important a part the engineering department takes in this work: first, by testing selections from the monthly output of each factory in the association, as well as lamps bought in the open market from factories not in the association. Second, by research and development work, which is constantly being done by experienced chemists, who not only investigate new metallic filaments, but who also perfect the present filaments in actual use to the highest possible degree. Technical data, which is acquired through the tests conducted in the engineering department, is embodied in the data book furnished by the engineering department to companies in the association. Much of the data of general interest is found in the bulletins which are distributed to those interested in illumination.

Bulletin No. 3 deals with the Gem

metallized fifty-watt lamp and gives a general description and cost analysis. A table showing the cost of power and renewals for 1,000 hours is given for the Gem fifty-watt and the ordinary carbon filament lamp. Figures are given for values of power from 0.6 to 12 cents per kilowatt-hour.

Bulletin No. 4 continues the subject of Gem metallized filament lamps, considering the high candle-power and Prismo types in connection with different reflectors. Curves of candle-power distribution are given for various units. Tables showing dimensions of the bulbs and shades and the cost of operating the Gem lamps are presented.

Bulletin No. 5 is devoted to the Tantalum lamp. A brief history and general consideration of the characteristics of the metal tantalum is given. This bulletin, like those on the Gem lamp, gives distribution curves with various types of reflectors and a cost analysis, comparing the Tantalum, Gem and ordinary carbon lamp. The subject of high efficiency lamps and peak loads is carefully considered and will be found of interest to central station men and those connected with isolated plants.

Bulletins No. 6 and No. 6A give data and tables concerning the new Tungsten lamp. The first is purely descriptive and considers the charactertistics of the metal tungsten, the operation of the lamp, the light quality, etc. Bulletin No. 6-A gives detailed information in regard to the Tungsten street series lamps, with a cost analysis showing the remarkable saving in cost of power and lamp renewals per 1,000 hours over an ordinary carbon street series lamp.

Bulletin No. 7 is the one previously mentioned, namely, the one dealing with data on illumination. An outline of the matter contained is as follows: "General Considerations," "Methods of Illumination," "Measurement of Light," "Illumination," "Wiring" and "Cost Analysis." The clear and concise maner in which the subjects are presented, together with the special tables carefully designed to minimize the labor of figuring illumination, make the bulletin useful to the novice, who can follow the calculation step by step, and also to the illumination engineer, who will find in the tables a means of rapidly solving any problem in illumination or wiring. These tables are especially valuable to architects, building contractors, illuminating engineers, electrical engineers and any person interested in the use of electric incandescent lamps.

The efforts of the association to disseminate information in regard to electric lamps and illumination has been fully appreciated by those who have seen its bulletins, because of the great interest shown in regard to those already published. They are entirely free and are mailed, as published, to those who desire to receive them. All that is necessary in order to be put on the permanent mailing list is to drop a postal to the engineering department of the National Electric Lamp Association, 4,411 Hough avenue, Cleveland, Ohio, giving name, address and occupation.

Marshall Field & Company Adopts Nernst Lamps.

One of the largest contracts ever placed for lamps for store lighting has just been awarded by Messrs. Marshall Field & Company, of Chicago, to the Nernst Lamp Company, of Pittsburg. It calls for 12,000 glower units for immediate delivery. The store will be equipped a section at a time, and on account of the vastness of the undertaking the complete installation will perhaps not be in operation until well along into the fall.

MARSHALL FIELD & COMPANY STORE, CHICAGO, ILL.

Perhaps no store in the whole world is better or more favorably known than the great merchandising establishment of Marshall Field & Company, but only those who have had the opportunity and time to walk leisurely over its thirty-eight acres of floor-space and view its wonderful displays of merchandise collected from all sections of the world are able to appreciate its magnitude. The store has a frontage on State street of 385 feet and covers almost the entire block bounded by State, Washington and Randolph streets and Wabash avenue. The average number of employés is 9,000.

While it does not rank as a regular department store, it handles a great variety of the better classes of goods, such as dry goods, millinery, men's and women's clothing and furnishings goods, carpets, furniture, wall hangings, leather goods, pottery, glassware, jewelry, bric-a-brac, books, shoes, toys, sporting goods, etc. In fine, there is scarcely a problem in store illumination that this vast establishment does not exemplify.

For some time the rebuilding of a large portion of the store has been in progress, and in order to have the entire property in keeping with these improvements, it was determined to install a new lighting system throughout.

Any change in the equipment of such a vast store necessarily involves too great an expenditure to warrant the adoption of any system until thoroughly tried out, and so, at great expense, various modern systems of store illumination were installed in different sections of the store and put to an exhaustive test before a decision was reached. In having been chosen as best suited to the various requirements of this great store, the Nernst system has received as high a mark of commendation as it would be possible to bestow.

Recognizing the importance of having

a lighting system that would be in keeping with the architectural features and the general tone of the store, that would be agreeable and pleasing to the eyes of the customers and show up fine textures and delicate tints in their true values and at the same time be flexible enough to admit of a uniform value throughout, Marshall Field & Company in trying out the various systems subjected them to perhaps the longest and most exhaustive test ever made.

The thirteen floors to be lighted vary in ceiling height from fourteen to nineteen and one-half feet. Two and three-glower lamps suspended on specially designed chain pendants hanging from three to five feet from the ceiling—according to height—will be used. The fixtures are particularly appropriate in design and the lighting units will add materially to the appearance of the store.

Incandescent lamps to the number of more than 40,000, in low hanging fixtures, were formerly used. The current is supplied by the Chicago Edison Company. D. H. Burnam & Company are the architects in charge of the new building construction, now practically completed. The new lighting system will be installed under the direction of F. J. Pearson, electrical engineer for Marshall Field & Company.

Metropolitan Electric Light Wire Connectors.

The accompanying illustrations show a line of wire connectors placed on the market by the Yonkers Specialty Company, Yonkers, N. Y. These connectors are for making connections and taps on electric light wires without the use of solder. Fig. 1 shows the type "A" tubular two-way connector. This consists of two sleeves internally threaded to receive the wires, with an external coupling nut which holds them securely together. The holes for the wires are tapered at the outer ends to protect the wires from a sharp bend at the point where the thread begins. Fig. 2 shows the thread tool which is used to cut the threads on the wire. This holds the wire in alignment, thus preventing a crooked thread, and also regulates the length of the thread cut. The type "A" connector has practically 100 per cent conductivity.

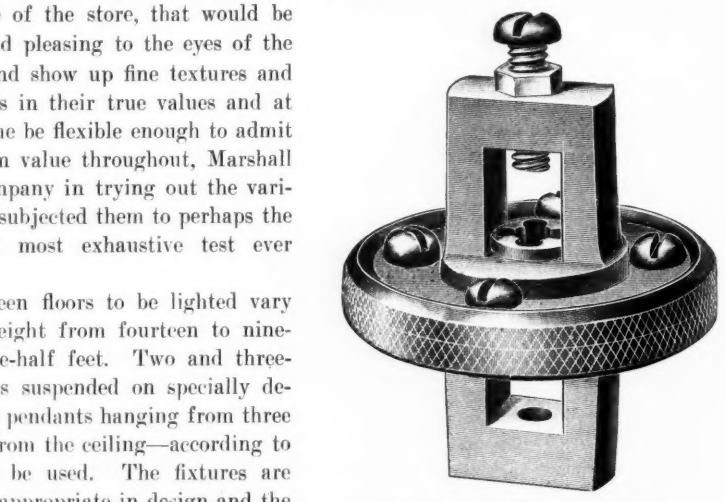


Fig. 2.—Thread-Cutting Tool.

Fig. 3.—Type "B" Tubular Tap Connector.

Fig. 3 shows the type "B" tubular tap connector. This is used for connecting wires of No. 6 B. & S. gauge and larger to either solid or threaded main-line wires of any gauge. The connector consists of a main shank with a hexagonal head, under which is a lateral slot to receive the main-line wire. A slidable sleeve is brought into engagement by a nut below, the sleever being grooved to fit the wire. Each size of connector will fit several sizes of main-line wire with sufficient accuracy. The branch wire is connected by a coupling nut and sleeve, or may be screwed directly into the shank if desired. For stranded branch wires a special connection not shown in the illustration is furnished.

Fig. 4 shows the type "C" flat two-way connector. This is used for connecting No. 8 and smaller wires. A flat brass plate is attached to an upper plate of spring brass. The end screws hold the wires and are tapped into the base plate. The spring brass serves as a washer plate, and also serves to keep the screws permanently locked.

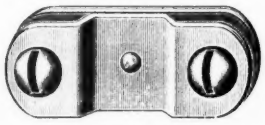


Fig. 4—Flat Two-Way Connector.

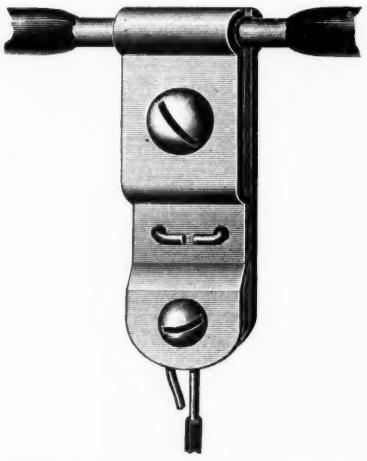


Fig. 5.—Type "D" Flat Tap Connector.

Fig. 5 shows the type "D" flat tap connector. This is used for connecting small branch wires to main-line wires, either solid or stranded. The jaws are adapted to a variety of sizes of main-line wires, and are tightened securely by a large screw and nut. The spring of the jaw plate insures a permanently tight connection. This connector has ample current-carrying capacity, and can be readily taped.

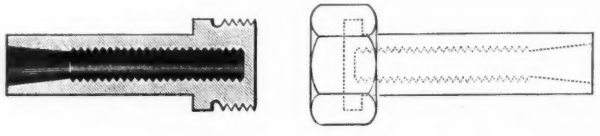


Fig. 1.—Type "A" Tubular Two-Way Connector.

Commutating-Pole Railway Motors.

The commutating-pole type of railway motor is specially well adapted to fulfil the requirements in railway motor design necessitated by the gradual increase of operating voltages on direct-current electric railways. The General Electric Company has, therefore, designed a railway motor of this type and is now manufacturing it in six different sizes, ranging from fifty horse-power to 200 horse-power. In Bulletin No. 4,508 these motors are described and illustrated, and the following advantages are enumerated: (1) very substantial mechanical construction; (2) practically sparkless commutation even on heavy overloads; (3) flashing at commutator largely reduced, if not entirely eliminated; (4) less wear on commutator; (5) cleaner and more reliable motor because of the reduced carbon and copper dust from brushes and commutator; (6) marked reduction in heating of commutator; (7) increased life of brushes; (8) lower magnetic densities and smaller core loss; (9) increased efficiency and free running capacity, because of lower core and commutator losses; (10) improved shape of speed curve giving greater economy during acceleration; (11) lighter field-coils to handle; (12) greater service capacity of motors possible by forced ventilation.

The theory and function of commutating poles have long been understood. In the General Electric motors these poles are located between the main exciting pole-pieces with their windings in series with one another and with the armature. The magnetic strength of the commutating poles varies, therefore, with the armature current, and the proper field intensity for perfect commutation is thereby secured. As the magnetizing current is reversed when the armature current reverses, the poles perform their functions equally well in whichever direction the motors are running. The commutating-pole motors contain the same general mechanical features found in the standard General Electric railway motor.

FIG. 1.—FLUSH ALL-METAL TELEPHONE.

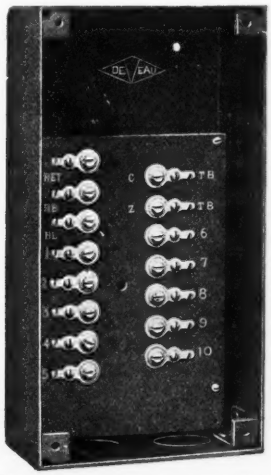


FIG. 2.—OUTLET BOX FOR FLUSH TELEPHONE.

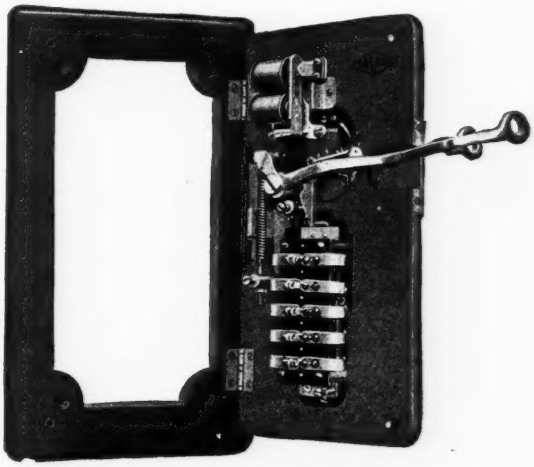
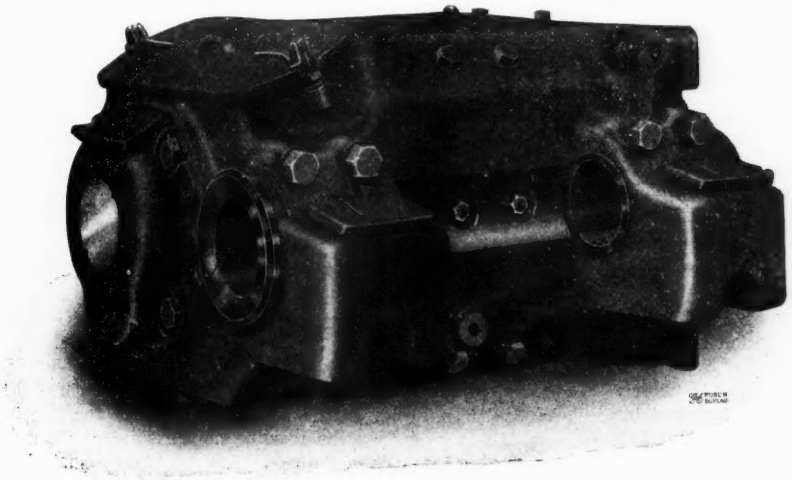


FIG. 3.—COVER AND MECHANISM FOR FLUSH TELEPHONE.



GE-205 RAILWAY MOTOR—BACK VIEW.

De Veau Telephone Apparatus.

In the evolution of telephone apparatus, the De Veau Telephone Manufacturing Company, 27 Rose street, New York, has recently perfected a number of new forms of apparatus. Especially worthy of notice are the types of flush, all-metal telephones for interior intercommunicating service. These are automatic switchless instruments, shown in Figs. 1, 2 and 3, and are made with ball-bearing mechanism, which contributes greatly to their ease and regularity of perfect operation. A feature also of this type of instrument is that it is now made for full metallic circuits, the result of which, non-interference, is fully accomplished.

A stenographers' telephone, arranged with a light, neat neck holster, horn mouth-piece transmitter, and watch-case receiver, is a recent addition to the De Veau line of apparatus.

Another instrument, designed for apartment service, which sets flush on the wall in connection with vestibule letter-boxes, is an attractive departure in telephone apparatus. This form of instrument cuts in the battery by lifting the receiver, and cuts out the bell with the same operation. The receiver is of the cordless adjustable type, and is non-destructible. These equipments are furnished in any hardware finish.

Current Electrical News

DOMESTIC AND EXPORT.

BIG EDISON ENTERPRISE IN ITALY—European advices state that the Edison Company, of Milan, is the head of the largest syndicate ever formed in Italy for the development of electrical power. The new concern, which is capitalized at $5,000,000, plans the construction of hydroelectric plants having an aggregate capacity of about 100,000 horse-power. The power plants are to be located in the Camonica Valley, in the Brescia district of northern Italy. The syndicate will furnish electrical energy to operate various traction lines in and around Milan and Como.

NEW WESTERN RAILWAY AND LIGHT COMPANY—Articles of incorporation have been filed for the Puget Sound International Railway and Power Company, of Portland, Me., with a capital of $2,250,000, by J. H. Drummond, G. M. Drummond, W. G. Chapman, Gertrude M. Horne, all of Portland, Me.; Benjamin Joy, J. S. Lovering, P. L. Warren, A. K. Todd and J. E. Rousmaniere, all of Boston, Mass. The object of the corporation is stated to be to build and operate a line of railway between Seattle, Everett and Bellingham, Wash., and British Columbia. This is the Stone & Webster corporation that will construct the interurban announced some time ago to be built between Seattle and Vancouver, British Columbia.

PROPOSED CHICAGO SUBWAY—Franchise rights for a new Chicago subway, to cost between $100,000,000 and $200,000,000, have been asked of the Chicago city council in an ordinance introduced by Alderman Winfield P. Dunn. It develops that the plans on which engineers have been secretly at work for a year or more were left as a legacy, descending from father to son. Shirlan D. Gookins, the son, it is asserted, has persuaded others to put the transportation planned by his father into actual practice. J. Ogden Armour, Thomas F. Ryan and other Wall street men are backing the enterprise. Eighty thousand dollars has been spent on plans already. William Penn Nixon is president of the Chicago Subway and Arcade and Traction Company, the concern which is asking for the franchise.

UNITED STATES GOVERNMENT ARRANGES FOR ELECTRIC POWER IN NEVADA—It is announced that the Federal Government has entered into a contract with J. B. Daniels, superintendent of the Nevada Wonder mine, under the terms of which the Government will erect a 5,000-horse-power electricity generating plant at a point on the Carson river where the waters of the Truckee enter that stream after being diverted through the great canal. There is a fall at this point of nearly sixty feet and the volume of water is about 1,200 second-feet. A portion of the power to be generated will be used for Government purposes and the balance will be purchased by Mr. Daniels for use in Wonder and other mining camps of Churchill. Some of the power will be utilized in operating a railway between Wonder and Fallon.

BALTIMORE ELECTRIC COMPANY INCREASES CAPITAL—A meeting of the stockholders of the Baltimore Electric Company was held at Baltimore, Md., June 28, at which the directors of the company were authorized to increase the capital stock by the issue of $1,000,000 preferred stock. The present capitalization is $2,500,000 common stock, and there is also a bond issue of $3,094,000. The proceeds of the sale of the new stock are to be used in wiping out the indebtedness on additional appliances recently installed by the company, which have increased the capacity of the plant 100 per cent. The remainder will be used for future extensions. The new stock is to be first offered to the present stockholders, who will be allowed until July 15 to subscribe, the remainder to be disposed of to a syndicate in which the firm of H. C. Brown & Company is interested.

NEW YORK, WESTCHESTER & BOSTON—R. E. Robinson, of No. 30 Broad street, New York city, has applied to Judge Dayton in the Supreme Court for an injunction restraining the New York, Westchester & Boston Railway and the Portchester Railroad Company from entering into an agreement to consolidate their interests so as to run trains of both companies over the tracks of the New York, Westchester & Boston company in the borough of The Bronx. The tracks of the two companies, as provided under the plan adopted when the franchises were granted, are to run parallel to each other in The Bronx. For the purpose of saving the cost of construction of the Portchester in The Bronx, it was practically agreed to have only one line of tracks in The Bronx and let both companies use them. George R. Graham, counsel for the railroad company, opposed the application.

MERGER OF LIGHT COMPANIES—There has been filed in the Oneida county clerk's office in Utica, N. Y., a certificate of merger by which the Utica Gas and Electric Company acquires control of the Herkimer County Light, Heat and Power Company, the Glens Falls Gas and Electric Company and the Consolidated Gas and Electric Company, of Whitehall. It also authorizes the Utica company to acquire fifty-one per cent of the stock of the gas and electric companies of Sandy Hill, Fort Edward and South Glens Falls. By this transaction the Utica Gas and Electric Company extends into territory with a population of 60,000. It takes in all the river towns in Herkimer county and extends as far north as Dolgeville. Work on a gas pipe line to Little Falls, twenty-two miles east, will be started at once to supply that city and intermediate towns with gas. There will also be an increase in the gas and electric service of Glens Falls, Sandy Hill, Fort Edward and Whitehall.

NEW POWER PLANT FOR KALAMAZOO, MICH.—A concern backed by Chicago and eastern capital is seeking admission to Kalamazoo, Mich., and through its representative, Frank W. Armstrong, will ask the city for a thirty-year franchise to do business. The object of this concern is to furnish power and heat to the large manufacturing institutions of the city, also to heat business blocks and residences by steam from a central station. Mr. Armstrong is authority for the statement that if granted the franchise desired the company will immediately begin operations and will erect a large power plant in Kalamazoo and extend its mains to all points needed, the initial outlay being about $1,500,000. A canvass of the local manufacturing institutions has been made during the past three months and the proposal has met with almost universal favor. It is planned to erect a plant with an initial capacity of 10,000 horse-power, with provisions for increasing this to 20,000. The plant will be gas-driven. A steam-heating system will be operated in connection with the enterprise.

MEXICAN LIGHT COMPANY'S PLANT CHANGES HANDS—The Mexican Light and Power Company has disposed of the equipment of the old Mexican Gas and Electric Light Company to the well-known banking house of L. B. Speyer & Company, for use in the lighting of the city of Campeche, for which Mr. Speyer has a concession under the name of the Campeche Light and Power Company. The price paid was $150,000. The Campeche Light and Power Company has obtained from the government of the state of Campeche a valuable franchise for the operation of this electric light and power plant. It has under this concession exclusive right to furnish the city of Campeche with electric light and power for twenty years. The amount to be paid for lighting the streets is guaranteed by the revenue of the state of Campeche as well as by the revenues of the city. The use of oil or petroleum for light in the streets of the city is prohibited from the time the company's plant begins to operate. The city agrees to pay $18,500 annually for sixty arc lights of 1,200 candle-power each and 200 lights of fifty candle-power each for lighting the streets.

PRELIMINARY WORK BEGUN ON LARGE POWER PLANT—Preliminary work has been begun on a great power dam on the Sacandaga river in the northern part of New York state. When it

is completed a lake will have been formed that will exceed Lake George in size, and electric energy to the extent of about 200,000 horse-power will be available. Attention has been called to the proposed plant on the Sacandaga by an application to the state authorities for permission to issue bonds for $3,232,000 to finance the project. The Hudson River Power Company, which controls the Spier Falls and Mechanicsville plants, is also behind the present project. It is planned to build the new dam near Conklingville, which is on the Sacandaga river near its mouth. The Sacandaga empties into the Hudson near Hadley, Saratoga county, several miles above Spier Falls. The dam, it is calculated, will be about a mile long and 100 feet high at its highest point. The lake it will create will flood a vast area, wiping out several towns and much valuable farming land. The lake, it is estimated, will be forty miles long and from two to three miles wide. The value of the farm lands and other property which will be wiped out makes a $2,000,000-bond issue necessary. The material from which the dam will be built will be mainly granite from the Saratoga hills, from the same quarry that furnished much of the granite for the exterior of the Capitol at Albany.

POWER COMPANY FILES LARGE MORTGAGE—The Harwood Electric Power Company has filed a copy of a first mortgage for the sum of $3,000,000 to the Girard Trust Company, of Philadelphia, as trustee, the document being dated June 1, 1907. The power company is one in which the Pardees, of Hazleton, are interested. Electric power will be supplied to extensive mining plants in that locality and electric light for towns and cities. The board of directors of the new company recently decided to increase the indebtedness of the concern from nothing to $3,000,000 and for that purpose caused a bond issue to be floated by the Girard Trust Company for that amount. The bonds are valued at $1,000 each and are classed as first mortgage, thirty-year, five per cent gold bearing bonds, the interest being payable every June 1 and December 1 in gold. Of the bond issue, $850,000 worth is to be issued at once and the balance from time to time in amounts of not less than $100,000 on any interest day, as directed by resolution of the board of directors, providing the power company shall have earned during the preceding fiscal year an amount over and above all existing fixed charges, including the payments to the sinking fund, equal to the interest charges on the bonds be paid to the said sinking fund. All bonds are to be dated June 1, 1907, and payable on June 1, 1937, with five per cent semi-annual interest in gold, clear of all taxes. A second mortgage is to be a first lien upon all of the property, franchises and privileges of the power company that it now has or is liable to secure in the future.

ELECTRIC ROAD TO YOSEMITE—It is learned that H. E. Huntington is to spend $3,000,000 on a modern electric railroad between Fresno, Cal., and the Yosemite. Surveys by way of Crane Valley, a distance of ninety-six miles, are complete. His project, combined with the new electric extension of the Central California Traction Company, between Stockton and Sacramento, *via* Lodi, is attracting considerable attention in railroad circles. He intends having a big system with Fresno as the centre. His San Joaquin Power Company will furnish the necessary motive power. The completion of the survey to Yosemite Park marks the close of the preliminary stage of the mountain electric line. The financing of the project is to be done by Huntington's Los Angeles office. From the survey, which follows the line of least resistance, it has been possible to form a close estimate of the minimum cost of construction. It was commenced last September and has been carried on under the personal direction of Emil Newman. The first and most difficult part was from Wawona to the Crane Valley. By the completion of the new road W. J. Barnett, J. Dalzel Brown, the Fleishackers and their associates in the Central California Traction Company will have ultimately 250 miles of electric road in and around Stockton. The line now building to Lodi will finally reach Sacramento. There it will connect with the Henry A. Butters electric system, running down from Oroville, Marysville, Chico and Red Bluff. In view of this, traffic by electric road from the head of the San Joaquin valley at Stockton up the great Sacramento Valley at far as Red Bluff will shortly be possible. Samuel M. McLenegan, formerly of the Huntington system in Los Angeles, has been appointed general manager of the new traction company.

NEW PHILADELPHIA TRACTION DEAL—Mayor Reyburn has signed an ordinance passed by the Philadelphia councils which virtually makes the city of Philadelphia a partner in the Philadelphia Rapid Transit Company, which controls all the street-car lines in the city. The ordinance was suggested by the Retail Merchants' Association with the object of increasing the efficiency of the general street-car service. The corporation is given limited franchises for all the lines in the city for fifty years, during which it is to share equally with the city all profits in excess of six per cent on the actual paid-in capital. At the end of fifty years the city reserves the right to purchase the property. The city will be represented on the board of directors by the mayor and two other persons selected by councils. The law also provides for the repeal of an ordinance passed in 1857 under which the city had the right to take over street railways at any time, and an ordinance compelling the removal of overhead wires. The company can not make new routes, increase its capital stock, assume leases or part with its stock without the consent of the city. A set sum is to be paid to the city every year to cover licenses, street paving, removal of snow and other items. A special meeting of the stockholders of the Philadelphia Rapid Transit Company has been called for July 18 for the purpose of the ratification of the contract. The by-laws are to be amended so that the board of directors shall be increased from eight to eleven members. William H. Carpenter, president of the Union National Bank, and Clarence N. Wolff have been elected by councils to represent the city on the directorate of the Philadelphia Rapid Transit, in addition to the mayor. It is also stated that a call of $5 will be made on the stock.

UNITED ELECTRIC COMPANY LEASED TO PUBLIC SERVICE CORPORATION OF NEW JERSEY—President Thomas N. McCarter, of the Public Service Corporation of New Jersey, has issued the following announcement of a 999-year lease of the United Electric Company of New Jersey to the Public Service Corporation: "The board of directors of the United Electric Company have authorized the execution of a lease of all the property and franchises of said company to the Public Service Corporation for 999 years, subject to ratification by the stockholders. The provisions of the lease call for the division, upon the consummation of the lease, of $400,000, estimated to be the surplus cash assets of the United Electric Company of New Jersey, and then a rental of three per cent for two years, four per cent for the next two years and five per cent thereafter. The board of directors of the Public Service Corporation has authorized the acceptance of said lease, if ratified by the United Electric stockholders. As the Public Service Corporation is the owner of approximately ninety-eight per cent of the capital stock of the United Electric Company of New Jersey, the rentals prescribed were agreed upon with special regard for the rights of the two per cent of stock of the United Electric Company not owned by the Public Service. Every precaution was taken to see that all stockholders should share equitably in the present surplus and anticipated earnings for years to come. The leasing of the United Electric Company to the Public Service Corporation will result in great advantage to both companies from operating, accounting and practical standpoints. As a result of the lease, the future financing of United Electric Company will be transferred to the Public Service Corporation." The $20,000,000 of stock of the United Electric is held largely by the Public Service Corporation as collateral for its issue of Public Service certificates, $19,516,000 having been deposited with the Fidelity Trust Company, the fiduciary agent of the Public Service Corporation, four years ago.

NEW INCORPORATIONS.

ALBANY, N. Y.—Earlville Electric Light Company, Earlville, Madison county. $10,000. Directors: G. H. Clark, B. S. Kittridge, J. R. Parsons, Earlville.

CHICAGO, ILL.—Wisconsin Traction Company. To construct an electric line from Chicago in a northwesterly direction to the Wisconsin line. $10,000. Incorporators: H. R. Yaryan, Lewis E. Starr, Walter F. Wandtke, Phillips P. Lynch, George W. Miller, all of Chicago.

BEVERLY, MASS.—North Shore Electrical Company, of Beverly. $25,000. President, Nicholas I. Allen, Jr.; treasurer, Alfred J. Paine, of Malden, Mass.; secretary, Maynard E. S. Clemons. It is reported that the company will buy up several electrical companies in the vicinity.

ELECTRIC LIGHTING.

INDIANAPOLIS, IND.—The Goshen Electric Company is preparing to erect a $50,000 plant.

ORANGE CITY, IOWA—Fire destroyed the Orange City electric light plant on June 25, entailing a loss of $10,000. The plant was not insured.

NASHVILLE, TENN.—The Merchants' Power Company, incorporated under the laws of the state of Delaware, has been admitted to do business in Tennessee.

MILWAUKEE, WIS.—Comptroller Paul Bechtner has signed a resolution instructing the board of public works to begin the construction of a municipal lighting plant.

JAMESTOWN, N. Y.—The lighting department has placed an order with the Western Electric Company for 200 arc lamps and the necessary equipment at a cost of $7,288.90.

GREENFIELD, MASS.—The Greenfield Electric Light and Power Company has asked for permission to erect poles for a high-tension power line across Rocky Mountain and the town from the river plant of the Turners Falls Company.

TALLADEGA, ALA.—A preliminary survey has been made in connection with the improvements contemplated for the power plant of the Alabama Power Development Company, and it is expected to begin the work at an early date.

BALTIMORE, MD.—The directors of the Mount Washington Electric Light and Power Company have elected the following officers: Thomas W. Offutt, president and general manager; Alten S. Miller, vice-president; Harry J. McIntyre, secretary and treasurer. The directors are: Thomas W. Offutt, Alten S. Miller, S. Davies Warfield, Walter R. Townsend and Richard A. Bevan.

PHILADELPHIA, PA.—The St. Clair County (Ill.) Gas and Electric Company recently formed by the consolidation of the Belleville Gas and Electric Company and East St. Louis Gas and Electric Company and controlled by the American Gas Company, of Philadelphia, has issued $1,200,000 first consolidated five per cent gold bonds. The capital stock is $3,350,000 common and $150,000 preferred.

HARTFORD, CT.—A favorable report of the committee on incorporations granting a charter to the Fairfield Light and Power Company has passed the state senate. The incorporators of the company are: Edwin S. Pickett, Joseph D. Flint, David A. Burr, W. M. Bulkley and others. The capital stock of the company will be $100,000 and it will furnish gas and electricity and water and gas power to the residents of the town of Westport.

ATLANTA, GA.—At a special meeting of council the North Georgia Electric Company was granted an extension of one year from June 26 to complete the work of installing its system within the city. The extension was given, however, with the proviso that should the company use the conduits of the Atlanta Telephone and Telegraph Company, such use should be limited to thirty years, which is the term for which the franchise was originally granted.

BROADALBIN, N. Y.—At a special meeting of the town board it was voted to have the streets of the village lighted by electricity. The Broadalbin Electric Light and Power Company took the contract to furnish lights for the sum of $400 annually. The contract calls for twenty-three lights of twenty-five candle-power each. The lights are to be placed at points to be determined by the town board. The electric company expects to have the line in operation by August 1.

COLUMBUS, OHIO—The People's Light, Heat and Power Company, of Springfield, in which local men are largely interested, is offering $150,000 of its recently authorized bond issue of $250,000 of five per cent bonds to its stockholders at 85. The remaining $100,000 has been placed in escrow to provide for the retirement of an existing issue of $92,000. It is stated that the stockholders are subscribing for the bonds and that the entire issue will be taken by them. A number of improvements are contemplated.

ALBANY, N. Y.—The town board of Coeymans has awarded a contract to the Atlantic Light and Power Company to light the villages of Ravena and Coeymans for five years. The company's bid was $20 for each thirty-candle-power incandescent lamp. The Upper Hudson Electric Company bid $13 a lamp to light the village of Coeymans, but the bid was rejected. The Atlantic Company is a local concern which recently secured a franchise. By October 1 it promises to have fifty lights in Coeymans and eighty in Ravena.

PAW PAW, MICH.—The contract for the construction of the new electric light plant for this village has been let to the Falkemau Construction Company for the sum of $34,604. This covers the building of the new dam, the furnishing of all new machinery and the necessary wiring to bring the current to the corporation line. The new water power is to be about a mile below the present plant. The area of the lake to be created by the erection of the new dam will be about 500 acres, the upper end of the lake being well within the limits of the town.

OGDEN, UTAH—Ogden will build a municipal lighting plant. This was decided at a meeting of the city council when a resolution was passed providing that the committee on lighting be given power and authority to make arrangements and agreements necessary to secure a water power site and rights. The same committee was given authority to purchase the same at a cost not to exceed $5,000. The proposition in view is to take the water from the Ogden river near the Wilson saw mill in Ogden cañon and pipe it to a point about a mile below the mouth of the cañon.

PORTLAND, ME.—Extensive repairs and additions are being made to the plant of the Consolidated Electric Light and Power Company of this city. A brick building forty-two feet by seventy feet is being built adjoining the large power plant on Plum street. In this building will be housed an additional steam boiler of 400 horse-power capacity and a new switchboard which will receive the current from the new power-house located at West Buxton. The plant at West Buxton is a water-power plant and will generate current at 25,000 to 30,000 volts, which is to be conveyed by overhead wires to a transforming plant on Sewall street.

OTTAWA, ONTARIO—The annual meetings of the Ottawa Electric and Consolidated Light, Heat and Power companies were held June 24. The year has been a very successful one and a dividend of five per cent declared. Officers were elected as follows: president, T. Ahearn; vice-president, F. P. Bronson; directors: Warren Y. Soper, Thomas Workman, Honore Robilliard, R. L. Patterson, Toronto, and E. R. Peacock, Toronto. The officers of the Consolidated Light, Heat and Power Company, which controls the Ottawa Electric and Ottawa Gas companies, are as above except that John Manuel replaces T. Workman on the directorate.

TELEPHONE AND TELEGRAPH.

CHICO, CAL.—Plans are being made to improve local telephone service. A general overhauling and extension of the system will take place.

PEKIN, ILL.—The Citizens' Telephone Company, of Pekin, is preparing to join Canton and Pekin by an independent circuit at a cost of $5,000.

COLUMBUS, OHIO—The Johnstown & Croton Telephone Company, of Johnstown, Licking county, has increased its capital from $50,000 to $80,000.

MANSON, IOWA—The Central Mutual Telephone Company, with exchanges in all the towns of Calhoun county, announces a reduction of fifty per cent in toll rates, effective July 1.

HOUSTON, TEX.—A local company is being organized to install an automatic system. The company will be capitalized at $600,000, and will be controlled by residents of Houston.

CHICAGO, ILL.—The Chicago & Western Telephone Company is pushing plans to hurry its contract with the Chicago Subway Company. The company replaces the Automatic Telephone Company. The controlling interests believe that 100,000 telephones will be installed within five years. More than $10,000,000 capital is required.

BOISE, IDA.—The Rocky Mountain Bell Telephone Company has entered into a contract with the Parma Telephone Company by which the lines of the Parma company will be connected with the Bell switchboards at Parma and Caldwell. The arrangement became effective June 15. The Parma company had been operating about 150 telephones at Parma and in the country near it. This arrangement will give the patrons of the Parma company all the advantages of the Bell local and long-distance lines.

PERSONAL MENTION.

MR. FRANK ARNOLD has been appointed superintendent of the electrical department of the Fort Dodge, Des Moines & Southern Railroad Company, with headquarters at Boone, Iowa.

MR. W. S. MENDEN, chief engineer of the Brooklyn Rapid Transit Company, will hereafter be in charge of the transportation department, succeeding Dow S. Smith, who has resigned. Mr. Menden has been with the company for two years past, coming from Chicago, where he was for several years general superintendent of the Metropolitan Elevated Company, being in direct charge of operation.

MR. F. J. J. SLOAT, general manager of the Cincinnati Northern Traction Company, has been made division manager of the Indiana, Columbus & Eastern Traction Company, still retaining his position as manager of the Cincinnati Northern. His offices will be transferred from Hamilton to Dayton, Ohio, and he will have charge of the western division of the Indiana, Columbus & Eastern between Dayton and Union City, Ind., and the Dayton & Western Traction Company, which is controlled by the former. Mr. C. E. Palmer will have charge of the Hamilton offices.

MR. HENRY C. HIGGINS, manager of the Sterling, Dixon & Eastern Electric Railway, Sterling, Ill., and also manager of the Lee County Lighting Company, Dixon, Ill., has resigned from these positions. Mr. Higgins has been part owner and manager of both companies since their organization, and built the interurban railway. His place will be filled by Edward B. Kirk, of Oshkosh, Wis. Mr. Higgins will retain his financial interests in the two companies and will continue as vice-president of the electric railway company. He will go to Gadsden, Ala., where he will be general superintendent of a gas and electric company.

MR. RALPH D. MERSHON sailed on July 2 on the Caronia for England, on his way to South Africa in connection with the work of the Victoria Falls Power Company. Mr. Mershon will be absent from the country for about three months. He will meet in South Africa a number of the directors and officials of the Victoria Falls Power Company and Arthur Wright, of London, England, who is directly responsible for the engineering of the steam stations which the power company is installing on the Rand. Mr. Mershon will go from Johannesburg to Victoria Falls, passing over the country through which the transmission line from Victoria Falls to Johannesburg and the Witwatersrand will be located.

MR. ROBERT JEMISON, of the Birmingham Railway, Light and Power Company, Birmingham, Ala., has resigned the presidency of the company to accept a higher position as chairman of the executive board, which gives him greater powers but relieves him of the active duties of directing the actual workings of the system. The resignation will take effect September 1, at which time President Jemison will become chairman of the executive board and will be succeeded as president by A. H. Ford, who is now president of the American Cities Railway and Light Company, with headquarters in New York city. For twenty years President Jemison has been connected in an official capacity with the street railway system of Birmingham and has been closely identified with the development of the system from a few unimportant lines to the present complete system of local and interurban lines. In 1887 he organized and built the East Lake street railway line which was run successfully for several years before it was merged with the other local lines, when President Jemison accepted a higher official position with the merger company and in 1901 became president of the reorganized system. A. H. Ford, who will assume the presidency of the local system on September 1, is a man of long experience in the street railway business and has worked his way up through the various departments of service. Before accepting the position which he holds at present he was superintendent of the street railways of New Orleans, La., for several years.

ELECTRICAL SECURITIES.

The Fourth of July holiday coming on Thursday of last week held business down to practically a three days' session, as most of those interested in the stock market prolonged the holiday over the week-end. Compared with a week ago prices show net gains, and the market continues firm, even under considerable realizing. There are many indications that the strife against all corporation development has spent a good deal of its strength, with the result that the business atmosphere has been purified and the public has a better understanding of its relations with these great industrial undertakings. The feeling of apprehension as to a considerable shrinkage in business has also disappeared to a great degree, and a period of continued prosperity is looked for rather than a course of pinching and privation. We have enjoyed a wonderful season, and have become used to good things. Every man, almost, is a capitalist of some order, and the struggle will be to keep things as they are or make them better, and for fear of doing worse, there will be a conservatism of action with regard to radical changes in administrative policy such as has never been possible before. The crop outlook, so menacing a month ago, has greatly improved, and nature is making up for lost time with a will that is encouraging if not inspiring. The harvest will be late, but facilities have improved, and the farmer will again secure a golden reward for his labors. A visit to any of the trucking farm regions will show bountiful crops, stacked high, day by day, and carried to market to be immediately disposed of. Another feature which is fast developing and one which is turning the farm into a most valuable factor, is the growth of towns and villages all about these small farms, furnishing a ready market for a goodly portion of the season's output.

ELECTRICAL SECURITIES FOR THE WEEK ENDING JULY 6.

New York:	*Closing.*
Allis-Chalmers common	11¼
Allis-Chalmers preferred	29⅜
Brooklyn Rapid Transit	60
Consolidated Gas	121¾
General Electric	138
Interborough-Metropolitan common	18
Interborough-Metropolitan preferred	46¾
Kings County Electric	120
Mackay Companies (Postal Telegraph and Cables) common	66½
Mackay Companies (Postal Telegraph and Cables) preferred	65
Manhattan Elevated	132¾
Metropolitan Street Railway	85
New York & New Jersey Telephone	100
Western Union	78
Westinghouse Manufacturing Company (ex-dividend)	142

The new 6 per cent collateral notes of the Westinghouse Electric and Manufacturing Company, sold to Kuhn, Loeb & Company, are for the purpose of meeting the 5 per cent collateral notes which mature August 1. The holders of the maturing 5 per cent notes due next month are offered the privilege of purchasing the new three-year 6 per cent collateral notes at 97½. At this price the new notes yield about 7 per cent. The maturing 5 per cent notes will be accepted at par and interest at maturity in payment for the new 6 per cent notes.

Boston:	*Closing.*
American Telephone and Telegraph	110
Edison Electric Illuminating	212
Massachusetts Electric	56½
New England Telephone	110
Western Telephone and Telegraph preferred	70

Philadelphia:	*Closing.*
Electric Company of America	9¾
Electric Storage Battery common	53
Electric Storage Battery preferred	53
Philadelphia Electric	8⅜
Philadelphia Rapid Transit	24
United Gas Improvement (ex-dividend)	93⅝

Chicago:	*Closing.*
Chicago Telephone	125
Chicago Edison Light	144
Metropolitan Elevated preferred	63½
National Carbon common	71
National Carbon preferred	114
Union Traction common	—
Union Traction preferred	—

Chicago Telephone Company during June gained 3,340 telephones, the total now in use being 190,153.

The daily average number of passengers carried in June by the South Side Elevated were 115,686, an increase of 13,916; by the Metropolitan Elevated 148,518, an increase of 15,455; by the Northwestern Elevated 99,051, an increase of 18,886.

ELECTRIC RAILWAYS.

WATERVILLE, ME.—The board of municipal officers has granted the Augusta & Waterville Street Railway a location on the city streets.

GRAND RAPIDS, MICH.—Percy T. Cook, of Brooklyn, Mich., has applied for a franchise to operate an electric railway on the streets of Grand Rapids.

IOLA, KAN.—R. C. Baldwin, of Iola, has been given the contract for grading work for the Iola Electric Railway Company's proposed extensions of its lines.

SALT LAKE CITY, UTAH—The Utah Light and Railway Company has filed with the city recorder an acceptance of the franchise recently granted it to operate a line in north town to the gravel beds.

MILWAUKEE, WIS.—The Columbia Construction Company, of Milwaukee, has received the contract for laying the double track for the Chicago & Milwaukee Electric Railway Company on the south side. The company has until August 27 to lay two miles of track.

MANKATO, MINN.—A street railway is to be built in Mankato entirely by local capital. A syndicate of local capitalists agreed to put up $50,000 if the citizens generally would put up $35,000. The last $2,000 has been subscribed and material has been telegraphed to be shipped at once.

EUGENE, ORE.—The Willamette Valley Company has received from the East two boilers of 300-horse-power capacity each for the Springfield plant. They will be utilized in furnishing power for the operation of the Eugene street railway line and the Eugene-Springfield railway. A large engine is also to be installed.

AMITYVILLE, N. Y.—The Huntington Railroad Company has accepted the franchise granted by the village officers and it is understood that work will begin at once. The franchise is for twenty-five years, with the privilege of renewal for another twenty-five years. The company will give a bond for $7,500 to the village insuring it against damage suits.

LEAVENWORTH, KAN.—A new power-house to cost between $300,000 and $400,000 and an electrical block safety system are improvements to be made by the Kansas City-Western Railway Company, which owns the Leavenworth electric line. The block system is now being installed at an expense of $20,000. The new power-house is to be in Kansas City, Walcott or Leavenworth.

WHEELING, W. VA.—The contract for the construction of the Fairmont & Mannington Electric Railway, fifteen miles in length and connecting two of the largest towns in the interior of the state, has been let to the Blodget Construction Company of this city. New York people are promoting the road. It is to be in operation in November. The construction will cost about $400,000.

ALBANY, N. Y.—The state railroad board has approved of the application of the Mineola, Roslyn & Port Washington Traction Company to change its name to the New York & North Shore Traction Company, to increase its capital stock from $150,000 to $1,250,000, and to issue a mortgage for $1,000,000 for financing. The Suffolk Traction Company has been granted consent by the commission to issue a mortgage of $1,000,000.

WASHINGTON, D. C.—The petition of the Washington, Alexandria & Mount Vernon Railroad Company for an extension of time from June 30 to December 1 for the completion of the installation of its underground trolley system on the approach to the new Highway Bridge across the Potomac has been granted by Secretary of War Taft. This decision conforms with an opinion rendered by Colonel Porter, acting Judge-Advocate General.

MANSFIELD, OHIO—The proposal of the Cleveland, Southwestern & Columbus Railway Company to purchase a controlling interest in the Mansfield Railway, Light and Power Company, was formally approved at a meeting of the directors of the company held in Cleveland. The local property, including the eight miles of track in this city and the twelve miles between here and Shelby, will be merged with the Southwestern and the two properties operated as one system.

HUMBOLDT, TENN.—A proposition has been submitted to the people of Humboldt and Crockett counties by an eastern syndicate, through Colonel I. H. Dungan, of this place, to the effect that if they will vote bonds to the amount of $130,000, the promoters will furnish $870,000, and construct an electric line costing in the neighborhood of $1,000,000. Humboldt proposes to vote $30,000 in bonds for this purpose, and Alamo citizens are said to be in favor of the proposition of voting $100,000 in bonds.

CHEHALIS, WASH.—B. J. Weeks, of Tacoma, has asked the city council of Chehalis for a fifty-year franchise for the Centralia-Chehalis Electric Railway and Power Company. Weeks made a statement as to the company's plans. It is proposed to build an interurban electric line between Chehalis and Centralia. He gives the assurance that actual construction will begin within sixty days and that he now has a mile of steel which is available for this line, with six miles more that he can divert here.

NEW YORK, N. Y.—Two large railway mortgages have been filed with the county register at White Plains. The largest is executed by the Hudson River & Eastern Traction Company, which is building several electric lines through the north end of Westchester county. The mortgage is for $1,000,000, in favor of the Colonial Trust Company, of New York. The Putnam & Westchester Railroad Company, which is doing similar work, executes a mortgage to the Knickerbocker Trust Company for $200,000.

ONEIDA, N. Y.—The Rome & Oneida Electric Railway's petition for a certificate of necessity has been denied. On December 20 last, the company filed an application for the necessary certificate of necessity, and on March 21 a public hearing was held on the application by the commission in the city of Utica. In its decision the board sets forth that it is not satisfied that the company is properly incorporated, and that the articles of association are defective. It also fears that the ten per cent of the capital stock was not paid in in good faith.

DENVER, COL.—An electric railway will be built from Denver to Morrison next year. John Brisben Walker, owner of the Caves of the Titans at Morrison, has induced eastern capitalists to take up the railway project, and the announcement is made that enough money to build the line has been promised. Mr. Walker has already secured a franchise and right of way through Jefferson county and before next spring will have made arrangements to enter Denver. The Denver City Tramway officials are discussing a plan to extend their line from Golden to Morrison. If this is done the two electric roads will no doubt have traffic agreements.

BROOKLYN, N. Y.—The board of estimate has formally approved the franchise giving the right to the Nassau Railroad, a subsidiary of the Brooklyn Rapid Transit Company, to build and operate an electric line on Livingston street, Brooklyn. The matter has been up for discussion for several months. The franchise is to run for ten years. The Brooklyn Rapid Transit Company has much of the necessary material already on the ground, and it is thought the work can be completed and the line placed in operation within three months' time. With the line in operation the company will be in a greatly improved position to handle its surface line traffic. The line will cost the company about $100,000 to build and place in operation.

CLEVELAND, OHIO.—At a meeting of the directors of the Cleveland, Southwestern & Columbus Railway Company a proposal to purchase a controlling interest in the Mansfield Railway, Light and Power Company was formally approved. The company will take over 5,050 shares of the common stock of the Mansfield company from a local syndicate headed by F. L. Fuller. There are 10,000 shares of common and preferred stock outstanding. The Mansfield property will not be merged with the Southwestern; the two properties will be operated as one system. A new power-house will probably be built in Mansfield capable of furnishing power enough for both the city lines and the new interurban line building in from Ashland. This purchase places the Southwestern in virtual control of the traction and lighting business in its territory between Cleveland and Columbus, with the exception of the Webb line from Columbus to Delaware and Marion. The Mansfield company is capitalized at $350,000 preferred and $650,000 common, and there are in addition $942,000 in five per cent bonds outstanding. The mileage includes eight miles of track within Mansfield and twelve miles between Mansfield and Shelby. The company also controls the lighting business in Mansfield. Franchises extend to 1925.

INDUSTRIAL ITEMS.

THE BRYAN-MARSH COMPANY, Chicago, Ill., has removed its New York city office to No. 1 Madison avenue.

THE GREEN FUEL ECONOMIZER COMPANY, Matteawan, N. Y., has published bulletin No. 108, descriptive of Green's mechanical draft apparatus.

THE LORD ELECTRIC COMPANY, New York city, announces that it has removed its factory and construction department to 213 West Fortieth street, New York city.

THE WARREN ELECTRIC MANUFACTURING COMPANY, Sandusky, Ohio, has published bulletin No. 30, describing and illustrating revolving-field alternators. This bulletin will be sent to any one interested upon request.

THE POWER IMPROVEMENT COMPANY, Chicago, Ill., announces that it has opened an office at 2,018 Fisher Building to handle De Laval steam turbines and the Wilkinson mechanical stoker. The office will be managed by George B. Foster.

THE AMERICAN SPIRAL PIPE WORKS, Chicago, Ill., has published a handsome catalogue describing and illustrating its forged and rolled steel pipe flanges. This catalogue is replete with handsome illustrations and interesting information, including dimensions, diagrams and price lists.

DODGE & DAY, Drexel Building, Philadelphia, Pa., announces that H. M. Beugler, formerly superintendent of railways for Ford Bacon & Davis, operating the Newman properties in Houston, Tex., Memphis, Little Rock, Birmingham, Nashville and Knoxville, has taken a position with the company.

THE JOHN A. ROEBLING'S SONS COMPANY, New York city, is distributing a beautiful souvenir in the form of a steel-plate engraving of the old Liberty Bell. This is in connection with the celebration of the proclamation of liberty, when the bell was tolled from the State House at Philadelphia on July 8, 1776.

THE FEDERAL RAILWAY SIGNAL COMPANY, New York city, announces that P. G. Ten Eyck has been appointed vice-president of the company, with headquarters at Albany, N. Y. The officers are now: president, J. T. Cade; vice-president, Lawrence Griffith; vice-president, P. G. Ten Eyck; treasurer, Frederick Pruyn; secretary, C. E. Newman.

QUEEN & COMPANY, INCORPORATED, Philadelphia, Pa., has ready for distribution a hanger illustrating its testing sets. The tests executed by these sets cover the entire field, some of the various uses being as follows: measuring resistances, measuring insulation, comparing electromotive forces, checking up voltmeters and ammeters, measuring battery resistance, capacity, self-induction, electrolyte resistance, executing Murray and Varley loop tests and testing-out grounds. This hanger will be sent to any one interested upon request.

EDUCATIONAL NOTE.

COLORADO COLLEGE—General William J. Palmer has given the Engineering School of Colorado College, Colorado Springs, Col., the sum of $12,000 to be expended immediately upon additional equipment for the engineering laboratories for senior work.

OBITUARY NOTE.

MR. LOUIS J. MAGEE, an electrical engineer and an authority on the construction and operation of electric street railways, died on July 3 at his home, No. 80 Madison avenue, New York city. Mr. Magee left a wife, who is a daughter of the late Dr. Henry Brainard Kent, of New York. Mr. Magee was born in Malden, Mass., in 1862, and was graduated from Wesleyan University in 1885, in which year he also entered the shops of the Thomson-Houston Electric Company. He was in charge at various times of work for this company in Peru, and in 1899 went to Hamburg as manager of its European office. In 1892 he organized the Union Electric Company, of Berlin, being a managing director until the merging, in 1903, of that company with the Allgemeine Electric Company, of Germany. Since 1904 he had represented the latter company in New York city. In the last three years he had had much to do with the arrangements between the General Electric Company, of Schenectady, and the German company in exchanging men from time to time for the widening of technical experience. Mr. Magee was a frequent contributor on German subjects to magazines, and wrote numerous articles for trade and technical magazines. He was a member of scientific societies here and abroad, and of the Lawyers' and Engineers' clubs, of New York city.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the Second Issue of Each Month.)

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AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth street, New York city. Meetings fourth Friday of each month.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th street, New York city.

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AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Professor Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Fifty-seventh street, New York city.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 12 West Thirty-first street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 33 West Thirty-ninth street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, Elmer M. White, assistant treasurer Birmingham Railway, Light and Power Company, Birmingham, Ala.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

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ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, P. C. Brown, Boston, Mass.

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CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada. Annual convention, Montreal, Canada, September 11-13.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allan H. Royce, president Toronto Suburban Railway, Toronto, Ontario.

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ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, John P. Faure, 77 Water street, Ossining, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckles Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall street, New York city. Board of directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Rolland A. Davidson, 58 William street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt street, New York city.

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ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Van Rensselaer Lansingh, Engineering Societies Building, 33 West Thirty-ninth street, New York city. First annual meeting, Boston, Mass., July 30-31.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Texas.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Tuesday of each month.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. S. Norton, Indianapolis.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Norfolk, Va., August 7-9.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles West, Allentown, Pa.; assistant secretary, J. A. Harney, Electric Building, Cleveland, Ohio.

IOWA STATE ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Iowa.

KANSAS GAS, WATER AND ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Topeka, Kan., October 16, 1907.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. S. Vivian, Grand Rapids, Mich.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George Schweer, Windsor.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee street, Utica, N. Y. Next meeting, Engineering Societies Building, New York city, July 17-19.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl street, Boston, Mass. Meetings held on fourth Thursday of every month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary R. Max Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, R. N. Kimball, Kenosha, Wis. Next annual meeting, Milwaukee, Wis., January, 1908.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next annual meeting, Toledo, August 20, 21 and 22.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, O. O. Welsheimer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Bullard, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OLD TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. C. B. Roulet, Mercury, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore. Annual meeting, Los Angeles, Cal., June 18-20.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Annual meeting, Milwaukee, Wis., October 8-10, 1907.

RAILWAY TELEGRAPH SUPERINTENDENTS' ASSOCIATION. Secretary P. W. Drew, Wisconsin Central Railway, Milwaukee, Wis. Next annual meeting, Montreal, Canada, June 24-26, 1908.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, W. I. Magruder, Ohio State University, Columbus, Ohio. Annual meeting, Case School of Applied Science, Cleveland, Ohio, July 1-3.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, So. Dak.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, R. B. Stichter, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York, N. Y.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, Chicago.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

National Electrical Contractors' Association. Annual meeting, New York city, July 17-19.

Illuminating Engineering Society. Annual meeting, Boston, Mass., July 30-31.

International Association of Municipal Electricians. Norfolk, Va., August 7-9.

Ohio Electric Light Association. Annual meeting, Toledo, Ohio, August 20-22.

Canadian Electrical Association. Annual convention, Montreal, Quebec, September 11-13.

Railway Signal Association. Annual meeting, Milwaukee, Wis., October 8-10.

Canadian Electrical Exhibition. Montreal, Quebec, September 2-14.

Record of Electrical Patents.

Week of July 2.

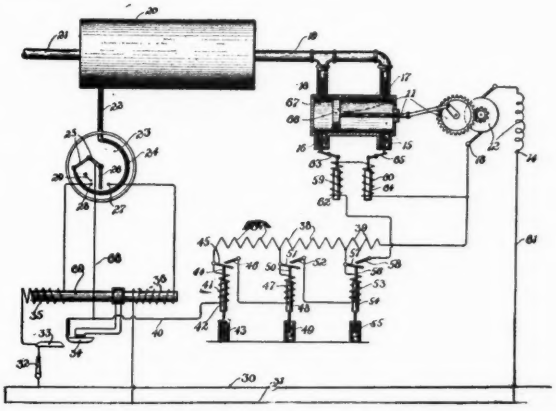
858,363. TELEPHONE-EXCHANGE. Clarence A. Anderson, Lindsborg, Kan. An automatic telephone switch.

858,377. ELECTROMAGNETIC REGISTER. Isidor Fluegelman, Philadelphia, Pa. An electromagnetic counting device.

858,383. MACHINE FOR MANUFACTURING INSULATING TUBES. Emil Haefely, Basel, Switzerland, assignor to Westinghouse Electric and Manufacturing Company. The tubes are made of successive layers of insulating sheets.

858,384. MANUFACTURE OF INSULATING TUBES. Emil Haefely, Basel, Switzerland, assignor to Westinghouse Electric and Manufacturing Company. The tubes are formed by winding a coated fabric on a mandrel.

858,385. METHOD OF MAKING INSULATING TUBES. Emil Haefely, Basel, Switzerland, assignor to Westinghouse Electric and Manufacturing Company. Insulating tubes are made of a varnish-coated fabric.



858,468.—CONTROLLING APPARATUS.

858,386. APPARATUS FOR MANUFACTURING INSULATING SOCKETS. Emil Haefely, Basel, Switzerland, assignor to Westinghouse Electric and Manufacturing Company. A machine for constructing sockets from layers of sheet material.

858,391. PRIMARY BATTERY. Charles E. Hite, Burlington, N. J., assignor to Hite Electric Company. The cell is divided into two compartments, one forming a reservoir for the electrolyte.

858,392. PRIMARY BATTERY. Charles E. Hite, Burlington, N. J., assignor to Hite Electric Company. The electrodes are packed in a porous depolarizing material.

858,399. CONTROLLER. Michael Kelly, Hammond, Ind., assignor to Frank S. Betz, Chicago, Ill. A rheostatic controller.

858,400. ELECTRIC-FURNACE PROCESS. Franz von Kügelgen and George O. Seward, Holcombs Rock, Va. A resistance furnace showing water-cooled electrodes.

858,425. METHOD OF CONTROL FOR ELECTRIC MOTORS. Norman W. Storer, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A series-parallel control system.

858,454. TELEPHONE SYSTEM. Edwin B. Heaford, Omaha, Neb. A manual exchange system.

858,467. AUTOMATIC DEVICE FOR STARTING MOTORS. Walter J. Richards, Milwaukee, Wis. A controller operated by fluid pressure.

858,468. CONTROLLING APPARATUS. Walter J. Richards, Milwaukee, Wis. A system operated by a motor-driven fluid pump.

858,469. FLUID-PRESSURE SYSTEM. Walter J. Richards, Milwaukee, Wis. A fluid-pressure system for alternating-current motors.

858,471. CONTROLLING APPARATUS FOR PRESSURE SYSTEMS. Walter J. Richards, Milwaukee, Wis. An apparatus for supplying fluid pressure for controlling electric motors.

858,474. ATTACHMENT FOR ELECTRIC METERS. William L. Saunders, Denver, Col., assignor of two-thirds to Daniel K. Hickey, Denver, Col. A casing for protecting the connecting wires of a meter.

858,476. SYSTEM OF CONTROL FOR ELECTRIC MOTORS. Otto S. Schairer, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A system which prevents a change in the circuit relation of the devices controlled, unless the current falls below a predetermined amount.

858,478. CONTROLLER FOR STORAGE BATTERIES AND SIMILAR PURPOSES. Frank L. Sessions, Columbus, Ohio, assignor to Joseph A. Jeffery, Columbus, Ohio. A controller for connecting storage batteries in series or in parallel.

858,481. SYSTEM OF CONTROL FOR ELECTRIC MOTORS. Norman W. Storer, Pittsburg, and William Cooper, Wilkinsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. A series parallel controller.

858,507. PROCESS OF ELECTRIC WELDING. Weston M. Fulton and John S. Brown, Knoxville, Tenn., assignors to the Fulton Company, Knoxville, Tenn. A material to be welded is passed between continually moving electrodes.

858,554. WIRELESS TRANSMISSION. Harold A. Yarnell, Los Angeles, Cal., assignor to Pacific Wireless Telegraph Company, Los Angeles, Cal. A reservoir consisting of a subterranean chamber, in which a large plate is suspended and connected to the aerial.

858,563. GALVANIC BATTERY. Benjamin J. Blameuser, Chicago, Ill. A battery within a double-walled case.

858,569. SPACE TELEGRAPHY. Sewall Cabot, Brookline, Mass., assignor to Stone Telegraph and Telephone Company, Boston, Mass. A plurality of oscillation detectors is employed.

858,574. ALTERNATING-CURRENT RECTIFIER. William B. Churcher, Cincinnati, Ohio, assignor to Kennon Dunham, Cincinnati, Ohio. An electrolytic rectifier.

858,591. CIRCUIT-CONTROLLING MEANS. Ellsworth E. Flora, Chicago, Ill., assignor to Zorge Safety Railway Equipment Company. The controller is actuated by two electromagnets.

858,611. ELECTRICAL SIGNALING APPARATUS. William W. Lovett, Los Angeles, Cal. The signaling apparatus is attached to a cable reel.

858,621. PROCESS OF ELECTRICALLY REDUCING OXID ORES. Albert J. Petersson, Alby, Sweden. An electric furnace into which the materials are fed separately.

858,622. METHOD OF CARRYING OUT METALLURGICAL REDUCTION AND MELTING PROCESSES. Albert J. Petersson, Alby, Sweden. The ore and carbon form parallel columns, the current passing the column of carbon.

858,623. PROCESS OF CONTINUOUSLY PRODUCING CARBID FROM LIME AND CARBON. Albert J. Petersson, Alby, Sweden. The carbon and lime are charged unmixed into the furnace.

858,632. SYSTEM OF ELECTRICAL OPERATION. Joel C. Slaughter, Dallas, Tex., assignor to Electric Auto-Transformer Company, St. Louis, Mo. The excitation of the generator is varied with the load.

858,637. TELEPHONE ATTACHMENT. William H. Stinson, De Funiak Springs, Fla. A telephone register.

858,668. RECEIVER FOR ELECTRICAL OSCILLATIONS. Peder O. Pedersen, Copenhagen, Denmark. An oscillating circuit.

858,676. SYSTEM OF ELECTRICAL OPERATION. Joel C. Slaughter, Dallas, Tex., assignor to Electric Auto-Transformer Company. A method of controlling alternating-current systems.

858,692. ELECTRIC CLOTH-CUTTING MACHINE. Edward M. Waring, New York, N. Y. A reciprocating knife.

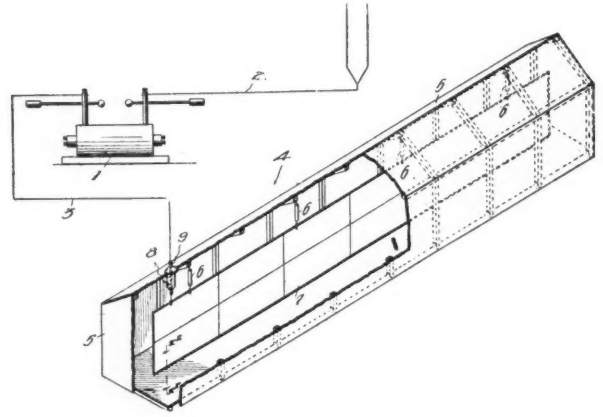
858,699. OUTLET-BOX. Leon W. Bossert, Utica, N. Y. An outlet for conduit systems.

858,700. OUTLET-BOX. Leon W. Bossert, Utica, N. Y. An outlet-box having a series of removable plugs.

858,720. SYSTEM OF ELECTRICAL DISTRIBUTION. Albert S. Hubbard, Greenwich, Ct., assignor to Gould Storage Battery Company. A storage battery system.

858,732. TROLLEY-POLE CONTROLLING DEVICE. William Lile, Venice, Ill. A spring-controlled trolley pole.

858,734. MAGNETIC SEPARATOR. Thomas J. Lovett, Chicago, Ill. A separator using a traveling belt.



858,554.—Wireless Transmission.

858,739. COMBINED PORTABLE TELEPHONE AND TELEGRAPH INSTRUMENT. Frederick W. Medhurst, Hobart, Tasmania, Australia. A high-tension induction coil.

858,767. SYSTEM FOR PARTY-LINES IN TELEPHONE EXCHANGES. Julius M. Storkerson, La Crosse, Wis. A system controlled by relays.

858,775. NIGHT SERVICE ATTACHMENT FOR TELEPHONE LINES. Clarence E. Ackerman, Vernon township, Shiawassee county, Mich. A switch for connecting a number of telephone lines together temporarily.

858,780. ELECTRIC-FURNACE PROCESS OF MAKING LOW-CARBON METALS OR ALLOYS. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Company. A heavy current is passed through relatively small electrodes.

858,797. SYSTEM OF ELECTRIC CONTROL. Wolfgang E. Ebert, St. Louis, Mo. The controlling switches are operated by electromagnets.

858,819. SUPPORT. William B. Oliver, Sharon Hills, Pa., assignor to Oliver Manufacturing Company, Philadelphia, Pa. A holder for telephone instruments.

858,821. ADJUSTABLE SUPPORT. William B. Oliver, Sharon Hill, Pa., assignor to Oliver Manufacturing Company, Philadelphia, Pa. An articulated telephone holder.

858,822. TELEPHONE STAND. William B. Oliver, Collingswood, N. J., assignor to Oliver Manufacturing Company, Philadelphia, Pa. A self-balancing telephone support.

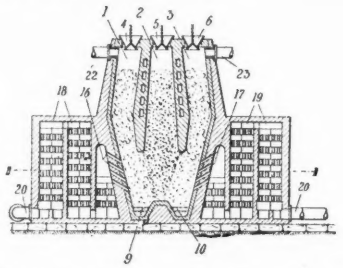
858,836. TELEPHONE EXTENSION-ARM APPLIANCE. Burton W. Sweet, Cleveland, Ohio, assignor, by mesne assignments, to Century Telephone Construction Company, Buffalo, N. Y. A removable bracket for telephone extension arms.

858,846. HOUSE-WIRING CONDUIT SYSTEM. Harry Alexander, New York, N. Y. A rectangular conduit.

858,862. PRIMARY AND SECONDARY BATTERY. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to Edison Manufacturing Company, West Orange, N. J. An electrolyte containing an alkaline silicate.

858,909. ELECTRIC BELL. Nelson H. Raymond, Brooklyn, N. Y., assignor to Alice C. Patterson, New York, N. Y. A method of construction.

858,928. IGNITION SYSTEM FOR EXPLOSION ENGINES. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. A coil and vibrator system.



858,621.—Process of Electrically Reducing Oxid Ores.

858,941. ELECTROMAGNET. George Baehr, McKeesport, Pa., assignor to National Tube Company, Pittsburg, Pa. The poles are provided with alternate interspaced projections.

858,944. TELEPHONE-RECEIVER HOLDER. Henry S. Bepler, Allegheny, Pa. A holder for telephone receivers.

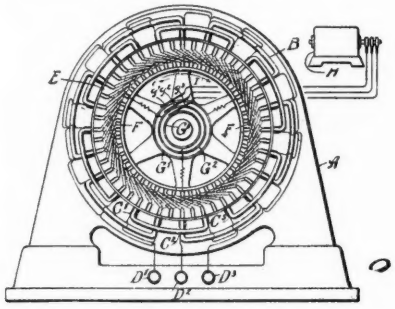
858,955. ELECTRICALLY HEATED TOOL. Walter G. Clark, New York, N. Y., assignor to Parker-Clark Electric Company, New York, N. Y. A resistance heater.

858,971. TARGET. Robert H. Fury, Baltimore, Md. An electrical registering target.

859,018. TRANSPORTATION SYSTEM. Franklin S. Smith, Philadelphia, Pa., assignor to Electric Carrier Company, Camden, N. J. A telpherage system.

859,019. ELECTRIC TRANSPORTATION SYSTEM. Franklin S. Smith, Philadelphia, Pa., assignor to Electric Carrier Company, Camden, N. J. The car is propelled by solenoids.

859,132. SMELTING PROCESS. Frederick T. Snyder, Oak Park, Ill., assignor to Electric Metals Company, Chicago, Ill. A process of smelting volatile metals.



859,143.—Method of Generating and Distributing Electrical Energy.

859,133. SMELTING FURNACE. Frederick T. Snyder, Oak Park, Ill., assignor to Electric Metals Company, Chicago, Ill. A water-cooled furnace.

859,134. SMELTING PROCESS. Frederick T. Snyder, Oak Park, Ill., assignor to Electric Metals Company, Chicago, Ill. Successive charges are treated separately.

859,136. ELECTRIC FURNACE. Frederick T. Snyder, Oak Park, Ill., assignor to Electric Metals Company, Chicago, Ill. A double-walled furnace cooled by a circulating fluid.

859,137. ELECTRIC FURNACE. Frederick T. Snyder, Oak Park, Ill., assignor to Electric Metals Company, Chicago, Ill. A double furnace containing smelting and condensing chambers.

859,143. METHOD OF GENERATING AND DISTRIBUTING ELECTRICAL ENERGY. William Stanley, Great Barrington, Mass. The machine is excited by an alternating current of low frequency.

859,147. AUTOMATIC ALARM DEVICE. Louis Strodtbeck, Middletown, Ohio. An alarm for fluid pipes.

859,178. PROCESS OF TREATING LIQUORS BY ELECTRICITY. Christian H. C. Koch, Chicago, Ill., assignor to Chicago Distributing and Trading Company, Chicago, Ill. Current is passed through the liquid from non-metallic electrodes.